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[The following are translations of selected articles from KONVERSIYA, a monthly journal published in Moscow on conversion and the defense industry.]

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GENERAL ISSUES

Raising the Effectiveness of Using Freed Capacities at Enterprises Undergoing Conversion

94UM00164 Moscow KONVERSIYA in Russian No 5, 1993 pp 3-5

[Article by Anatoliy Dmitriyevich Tarusin and Dr Tech Sci Nikolay Fedorovich Gusev, Central Scientific Research Institute of Economics and Conversion of Military Production; the particulars of calculating the production capacities of enterprises under the conditions of conversion are examined in an article by the same authors in KONVERSIYA, No 4, 1993]

[Text] *The problems and ways of raising the effectiveness of using production capacities freed in the course of conversion are examined.*

In 1992 conversion of the defense sectors of industry in the Russian Federation assumed an "avalanche" course, owing to which military production decreased by 68 percent as compared to 1991.

A general production slump is also observed in industrial production. For example, the volume of industrial production at enterprises undergoing conversion in the Nizhegorod region decreased in 1992 by 28.4 percent of 1990's figure.

It should be noted at the same time that by the end of 1992 the rate of release of fixed productive capital used for military production at enterprises of the Russian Federation grew by a total of three to four times in comparison with 1990.

However, only 42 percent of all fixed productive capital freed as a result of conversion was put to other uses in the last 3 years; the rest was either mothballed or liquidated.

The problem of raising the effectiveness of using freed capacities to increase civilian production has become especially urgent in connection with the low level at which released fixed productive capital is being put to other uses.

In solving this problem, attention was turned to enterprises of the defense sectors to determining the ways and methods of raising the effectiveness of using freed production capacities and fixed productive capital, and at revealing the necessary extent of their mothballing for mobilization purposes.

The effort was based in this case on the need for eliminating the negative consequences of conversion brought about by causes within the production operations themselves, and on the other hand, for developing measures to raise production effectiveness and increase civilian production.

In 1992 defense sector enterprises drew up programs for conversion and measures by which to carry it out, which

should help to eliminate the unmanageability of conversion observed in 1989-1992, and to raise the level of use of released production capacities.

According to estimates, manufacture of civilian products in 1993 using capacities placed into operation in 1992 under priority conversion programs should total 233 billion rubles, including over 80 billion rubles in consumer goods. If we compare these figures with the amount spent on loans (R77 billion), the high potential effectiveness of conversion is obvious.

However, the absence of sufficient financing of planned measures to raise the effectiveness of production and to use freed production capacities continues to be the main difficulty in implementing conversion programs.

At the same time, external causes independent of the enterprises continue to act, affecting the progress of conversion negatively, in connection with which it would seem necessary to examine, at the state level, the following proposals directed at raising the effectiveness of conversion:

1. We need to define more specifically the concept of future conversion with regard for the requirements of military doctrine pertaining to defensive sufficiency, and for market relations. The most effective forms and directions of conversion—those which would both preserve a sufficient defensive potential for Russia and satisfy the public's demand for the most important types of civilian products—need to be determined.

2. In many ways the effectiveness of conversion depends on maintaining an integrated approach to carrying it out. Integrated programs and projects of sufficient breadth, bringing together the conversion programs of the individual defense enterprises of one or several regions, must become the heart of this approach.

In these cases, the freed capacities could be provided to a number of large enterprises that are slated for complete conversion. Furnishing modern, progressive equipment to these enterprises must be foreseen, which will make it possible to assimilate the manufacture of new, competitive types of civilian products. Specific loans granted for this purpose could be paid off in the shortest time and returned to the budget.

3. The effectiveness with which the released production capacities of a region are used can be increased by organizing intersector enterprises to manufacture civilian products. Such enterprises should be established after studying regional demand and the possibilities of satisfying it.

Such measures will make it possible to improve the overall infrastructure of civilian industrial production within the region through the active inclusion of converted enterprises into it. The latter can transfer part of the fixed capital and capacities freed in the course of conversion to the intersector enterprises—for example,

metal plating, paint and varnish and woodworking operations, certain types of assembly operations, and sections (or shops) manufacturing printed circuit boards.

Gradually concentrating the development and production of armament and military equipment at narrow-profile, deeply specialized state scientific-production associations and enterprises that are not subjected to conversion is recommended in this connection.

At the same time, enterprises in which civilian products dominate the production structure should be placed into a separate group in each sector of the defense complex. Manufacture of modern, competitive products should be concentrated at these enterprises.

4. In order to catch up in the technology of producing many types of civilian products and inject the scientific and productive potential of the defense complex into the development of science and technology, the creation of regional and sectoral specialized industrialized centers for the development and introduction of new technologies is recommended. Special attention should be turned to developing production lines and dual-use procedures as the basis for raising the mobilizational readiness of defense enterprises.

5. An analysis of the progress of conversion would show that subsidies to enterprises undergoing conversion, used to increase wages to the average level, are basically making it possible to keep the number of workers constant. However, because of their small work load and the production slump, labor productivity is decreasing. Owing to this, payment of such subsidies needs to be halted in a number of cases, and assets released from the federal budget should be directed at increasing the amounts of advantageous specific-purpose loans used to expand and re-equip production of new models of series-produced civilian products.

6. In addition in order to raise the effectiveness with which production capacities released in the course of conversion are used, we need an integrated program for improving the use of output capacities in general, one which would include measures of economic stimulation.

Economic stimulation must act upon enterprises in which conversion is being carried out, regardless of the level of use of production capacities, and it should encompass all structures within a given production operation.

Prices, taxes and tax advantages (and fines in certain conditions), and specific-purpose grants and subsidies may be used as the principal levers of economic stimulation. Tax advantages and grants may be used to stimulate faster respecialization of released capacities for the manufacture of civilian products. The range and assortment of these products should be determined by priority conversion programs such as "Rebirth of the Russian Fleet," "Conversion in Civil Aviation," "Conversion in the Timber Industry Complex" and "Conversion in Processing Sectors of the Agroindustrial Complex." It

would be suitable to use advantages in payments out of the profits of enterprises to encourage workers and to reduce payments for fixed capital depending on growth of the output-capital ratio and reduction of the capital-intensiveness of production.

7. In order to make use of the economic mechanisms of control, we need to establish scientifically substantiated reference norms and standards for indicators of the use of existing capacities and of assimilation of respecialized capacities and ones introduced according to plan.

8. In order to improve financing, crediting and encouragement of the development and introduction of new equipment and production procedures, and to convert production to the manufacture of new products, we need to:

- reduce interest rates on loans used to respecialize released capacities for the manufacture of civilian products;
- review the tax system for enterprises undergoing conversion in order to place them in preferential conditions in comparison with other enterprises;
- introduce advantageous terms into leasing agreements, and eliminate restrictions on growth of wages in enterprises actively involved in respecialization of freed production capacities;
- include civilian products manufactured by the defense sectors of industry into the category of products receiving preferential treatment (as nondietary consumer goods);
- develop a system of standards by which to stimulate full use of respecialized production capacities by production subdivisions within enterprises;
- introduce sufficiently stiff sanctions for failure to fulfill contracted cooperative deliveries to enterprises undergoing conversion and participating in active respecialization of capacities;
- organize a system at enterprises undergoing conversion for training specialists in entrepreneurship for work under market conditions;
- develop a state system for stimulating enterprises undergoing conversion and enjoying success in implementing priority conversion programs;
- draft normative acts supporting priority socioeconomic development of those enterprise which are improving the use of capacities respecialized for civilian production and are increasing product output;
- create a special fund at enterprises undergoing conversion and introduce a system of economic stimulation of the development and introduction of measures directed at making maximum use of released production capacities to increase production of civilian products and upgrade their quality;
- improve the system of standards for transfers from product cost into the new equipment fund in order to hasten respecialization of capacities and production of new types of civilian and military products formerly not produced in the Russian Federation and supplied by former union republics;

- develop and introduce standards at enterprises undergoing conversion for the transfer, into the currency funds of the enterprises, of a part of the assets received for introducing and increasing the output of products for export and improving their consumer properties.

9. Conversion is making it necessary to carry out organizational, technical, procedural, economic and financial measures aimed at redistributing capacities between operations manufacturing military and civilian products.

In order to raise the effectiveness with which freed production capacities are used, it is especially important for enterprises undergoing conversion to choose the right alternative civilian products to replace military products removed from production, with regard for the existing production processes and productive resources. In order to permit sensible selection of such products and improvement of material and technical support to enterprises undergoing conversion, and to permit study of the product market, demand and supply, we need to establish regional scientific research centers of conversion and marketing.

10. Determining the production capacities of currently operating enterprises acquires special importance during conversion, inasmuch as it provides a possibility for continual accounting, analysis and evaluation of production resources, for identifying production capacities released as the result of conversion, for solving the problem of selecting alternative civilian products, and for assessing the level of use of released and respecialized capacities.

In this connection we need to introduce indicators for the release, respecialization and use of capacities at enterprises undergoing conversion as the most important criteria addressed in the required statistical reports submitted by them to higher bodies.

Implementation of the proposals set forth here will make it possible to draw up realistic conversion programs, to avert the decline in production and to promote an increase in the effectiveness of industrial production and use of production capacities at enterprises undergoing conversion.

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Prospects for Development of Russia's Closed Cities in Connection With Nuclear Disarmament

94UM0016B Moscow KONVERSIYA in Russian No 5, 1993 pp 6-10

[Article by Cand Phys-Math Sci Vladimir Andreyevich Gusev, Kharkov Physicotechnical Institute]

[Text] *The particular features of closed cities established for implementation of the USSR's nuclear weapon development and production programs are examined. An analysis of the current problems of these cities and a forecast of the socioeconomic situation in connection with conversion of the principal production operations are offered.*

The atomic industry sector, which is a practically closed structure in terms of production procedures, socioeconomic features and organization, is one of the most complex and important sectors of the Russian military-industrial complex from the standpoint of conducting deep conversion. The acuity and scale of the problems associated with the need for reorganizing it, the special responsibility carried for decisions made in this area, and the greater attention focused on its status within the country and abroad are making it necessary to analyze the specific features of the function of Russia's atomic complex and to evaluate the prospects of its development, both within the context of the situation created by nuclear disarmament on a large scale, and within the wider framework of the future uses of atomic energy.

Ten closed cities established in the early 1940's and mid-1950's to implement the USSR's programs for development and production of nuclear weapons are the heart of Russia's atomic industry. First among them were Arzamas-16 and Chelyabinsk-65, where production of the necessary nuclear materials was organized, and the first nuclear devices were planned and manufactured. These cities were planned and erected under high secrecy as huge scientific-production complexes and settlements with a practically self-contained life-support infrastructure and with a great reserve of possibilities for development. Being dispersed territorially and enjoying significant redundancy in output capacities, the country's atomic complex possessed a high degree of reliability and stability. Intensive development of this complex continued over the course of several decades, up until the mid-1980's. The best scientific and engineering personnel trained in elite institutions of higher education were brought together, increasingly more complex procedures and equipment were developed and tested, and the engineering and social infrastructure was enlarged in this complex. This sector was always an object of persistent attention on the part of the political and military leadership, and it never experienced any serious difficulties in the supply of material and financial resources. As a result, a closed complex characterized by unique scientific, productive and social parameters was established. Not only did it ensure the USSR's parity in the area of nuclear weapons per se, but it also permitted us to attain the highest world level in atomic, radiation and

chemical technologies, in materials science, in reactor building, in analytical instrument making, and so on. Its self-contained nature and the presence of all of the necessary elements of self-support (its own personnel training system and its own huge construction complex separate from the statewide systems of financial, material and technical support) made a unique imprint upon the productive and social organization of the closed cities and upon the psychology of people working and living in them, and they are now creating problems unique to these formations in connection with general economic transformations and conversion.

Before going into an analysis of the problems faced by closed cities today, we will once again note their unique features that are of importance to evaluating the possible strategies and tactics of conversion in atomic industry.

Most important in this aspect are:

1. The singularity of function of the main production operations, and underdevelopment of alternative forms of activity and infrastructures.
2. The uniqueness of production operations and production procedures, fundamental difficulties in respecializing them for the output of alternative products.
3. The great uniqueness of the social organization of the cities, the closed nature of social relations at work and in the social context, confined to the enterprises and to the atomic sector.
4. Weakness and underdevelopment of the material base of bodies of local management.
5. A history of many years of preferential supply of productive and consumer resources and the associated relatively low social activity of the population, comparatively high standards of living, and an orientation of the majority on preserving currently existing social and production relations.
6. Practically total exclusion of the cities from the life of regions in which they are located (oblasts, krays), and tense relations with government structures and with the population of surrounding territories.
7. Rather stiff administrative restrictions on the population's migration, and special entry-exit conditions.

These features, plus the uniqueness of the products, sharply aggravate practically all problems accompanying conversion: Employment, re-specialization of production operations, use of qualified personnel, salvaging of raw material reserves and unwanted products, repair of ecological damage inflicted, establishment and development of territorial and extraterritorial cooperative production and foreign economic activity, a rigid relationship with sector infrastructures, and so on.

Let us make a slight digression with the purpose of comparing (and contrasting) these cities with special scientific, scientific-production and social facilities

known to exist abroad—industrial parks and industrial metropolises. Our cities are comparable in regard to their saturation by scientific-technical and technological potential, while in output they surpass known industrial parks of the large research centers of the USA and Europe. And when we account for the developed social infrastructure, they may be viewed as models for cities of the future—industrial metropolises. However, this correspondence is only an outward one, oriented only on the set of elements they contain. The moment we consider the structures joining these elements into a single whole, and the means and goals of organizing the life of both these cities themselves and the larger systems into which they fit (the atomic sector, the regions in which they are located), another impression immediately arises. In terms of the goals and meaning of their activity, closed cities are opposite to industrial parks and industrial metropolises in many ways. This is seen most clearly in the following: Establishment of industrial parks and industrial metropolises had, and continues to have, the goal of not only (and not so much) providing the conditions for effective industrial application of scientific results, but primarily of promoting dynamic development of the territories and regions of their location through the incorporation of the results of the activities of industrial parks into the socioeconomic and cultural spheres of these regions. Besides engaging in scientific and production activity, industrial parks and industrial metropolises create new social and cultural models for the organization of the life of people, and they should be viewed as the starting points for modernization of surrounding reality.

Closed cities were established for something else. Without casting doubt upon the substantial contribution made by these formations to the development of science and technology, we can assert that their influence upon the social, economic and cultural development of the country and different territories was minimal. Scientific, technical and technological results obtained within them were used outside the military sector to only a small degree (peaceful atomic industry was created primarily by other enterprises), and they had practically no positive influence upon the organization of life and activity in the zones in which they were located. Moreover, their activity did considerable damage to the surrounding nature and to the life of people on contiguous territories. The unique way in which life and activity were organized within these cities, almost military in a certain sense, led to the freezing and not to rejuvenation of social relations. [Social relations] in many ways remained at the 1950-1960 level, which is a cause of additional difficulties arising there today in connection with economic reforms.

In 1991 and in early 1992 the author was able to participate with a group of experts in the analysis and forecasting of the socioeconomic situation of closed cities in connection with conversion of the main production operations. The rest of this article is based on the results of this analysis and on articles published in the periodical press, including that of atomic industry.

Before evaluating the most probable scenarios for the development of the situation in these cities, I will briefly describe the attitude of the principal characters and social groups toward the developing processes.

The leadership of the Russian Federation Ministry of Atomic Energy is chiefly interested in preserving the currently existing production and economic complex and its role in managing its activity, in full correspondence with the traditions and logic of a sector-based organization of production. Having been placed in a position in which they are compelled for the first time to solve problems pertaining not to further development of the complex but to its survival, Ministry executives are directing their efforts primarily at easing the principal consequences of the abrupt shut-down of a number of production operations by introducing special budget subsidies and advantageous loans, and securing a special legal status for closed cities. In addition to this, the Ministry has developed and is now implementing several major conversion programs which are making use of the great scientific and productive possibilities of the special integrated works. These promise, under the conditions of their implementation, technological breakthroughs of Russian industry in microelectronics, fiber-optic communication systems, production of especially pure rare-earth and precious metals, precision machine building and instrument making, and in a number of other fields. However, because these programs were written to a significant degree on the basis of the logic of traditional sector management, and because they do not contain sections dealing with conversion of social and production relations equivalent to sections addressing conversion of production per se, there are doubts as to how realistic these programs can be.

In many ways the directors of the main production operations of closed cities occupy a similar position in relation to conversion and the mechanisms of its accomplishment, with the one difference that they have a better understanding of the shortcomings of many traditional forms of organization of sectoral production, and of existing social relations. To the extent their possibilities allow, this group of executives is making attempts to reform the established traditions, and it is seeking possibilities for cooperative production outside the sector structures. However, the scale and complexity of the problems, the general crisis and the absence of any experience in independent programming of their activity, forces most of them to operate within the mainstream of sector policy.

Until recently the leadership of the local management bodies of closed cities had very few possibilities for influencing the occurring processes, because the principal managerial functions were concentrated in the hands of the directors of the integrated works on the basis of which the cities were established, and in the hands of ministry executives, who allocated the basic resources to the cities, including centralized deliveries of products, goods and services. Consequently, representatives of the city administration had a rather superficial

acquaintance with the programs and prospects of conversion of the principal enterprises. As a rule, they were not included in the drafting of these programs, and they did not possess sufficient information on the probable socioeconomic consequences of implementing (and failing to implement) these programs. Hence the often-observed negative attitude toward the idea itself of conversion as toward a phenomenon that is destroying the rather comfortable and tranquil urban existence, and the desire to solidify the established organization of social and production relations.

The situation began to change in early 1992, when executives of the management bodies of closed cities, who came to recognize their responsibility for the consequences of the processes under way, began actively initiating the adoption of legal acts at the federal and sector levels called upon to solidify the evolved realities and the peculiarities of these formations, and to reduce the acuity of crisis phenomena in the socioeconomic sphere, at least for a transitional period. It was precisely owing to this activity that a Russian law on the status of closed cities that defined the legal framework of their existence for the first time was adopted in mid-1992, and that the Association of Cities, called upon to collectively defend their interests at the federal, sector and regional levels, was formed.

The decades of special and strict occupational selection, participation in work on supersecret programs, cooperation with outstanding scientists and production organizers and, finally, the high standard of living, all made a definite imprint upon the psychology of the elite population group of the closed cities (scientists, technicians, engineers and highly qualified personnel of atomic facilities), and made most of the people feel themselves to be members of a select group. Implementation of conversion programs, the complex processes of economic and political transformations, and their unavoidable negative consequences were often perceived by this group as the downfall of their value system and as the possible disappearance of the meaning of their life and activity. The natural pride borne by the creators of "Russia's nuclear shield" lost its basis, and a feeling of insult and confusion appeared, aggravated by the reality of subsequent disintegration of the professional collectives, membership in which had given meaning to life. It is precisely for this reason that an attitude toward conversion as a destructive phenomenon imposed from without manifests itself most strongly in this milieu.

The following are the probable scenarios for the development of the situation in closed cities.

The possibilities for preserving scientific and production potential and for preventing disintegration of professional collectives and departure of the leading specialists to other spheres of activity are among the main problems of conversion of atomic industry. Their solution is determined in many ways by the ability of federal and sector management systems to formulate new long-range goals for the activity of Russia's atomic complex, ones

equal in importance to those that disappeared in connection with radical nuclear disarmament. This is not an easy thing to do, inasmuch as the objective should be not to substitute certain goals (the "nuclear shield") by others, but to utilize a fundamentally new multipurpose system of activity, the goals of which would be equivalent in their sum total to the former goals, which have already been exhausted in many ways. The search for and selection of such goals should obviously proceed in contemporary science-intensive directions such as solving global ecological problems, developing atomic and thermonuclear power engineering, using radiation technology in industrial and agricultural production and in medicine, creating a Russian microelectronics industry, etc. Obviously there is little hope of quickly reorienting the atomic complex onto new directions of activity in the present economic and organizational crisis. Implementation of programs of such complexity will require time and impressive resources. Consequently a pause during which the quality of Russia's scientific and production potential attained in previous years could suffer is inevitable. This pertains chiefly to those cities in which production was centered primarily on fissionable materials and nuclear devices. The level of employment and use of potential associated with shutting down military reactors, destroying ammunition and processing nuclear materials and wastes could hardly provide a full load for the industrial complexes. And their relatively rapid reorientation onto peaceful atomic power engineering is impossible due to the great decrease in the rate of this sector's development following the Chernobyl disaster.

The evaluation of the situation is somewhat more optimistic in the area of atomic research and development, in which there are relatively large possibilities for changing the orientation of research. There is a relatively lower demand for investment resources and—something else that should also be considered—a demand for developing future weapons remains. Consequently we can expect that the consequences of global conversion in the sphere of nuclear arms will turn out to be less painful to cities such as Arzamas-16 and Chelyabinsk-70, which have been transformed into Russia's nuclear centers. Of course the scientific collectives of the enterprises of these cities may be threatened by a danger coming directly from their new status. In trying to preserve the scientific and technical potential of these centers, and financing their activity at a level which is sufficient for survival but failing to define new, meaningful goals and objectives for them, it is possible to provoke and accelerate demoralization in the collectives, which would be unavoidable if the meaning of activity and the motives of development disappear.

Deep conversion of the main enterprises inevitably reflects upon the social sphere of such cities, and more harshly and definitely than upon the social sphere of open territories at that. Because of the worsening of financial possibilities, enterprises are striving to free themselves of the responsibility of maintaining the social

infrastructure with their own money, which, given the shortages in city budgets, is leading to the degradation of this infrastructure.

The standard of living of the people is decreasing faster and more dramatically than in the rest of Russia, and employment problems, aggravated by the absence of alternative labor-intensive production operations and specific restrictions upon the people's migration, are becoming more acute. At the same time, "blurring" of the boundaries of cities has already begun, and it will continue to intensify. An increasingly larger part of the population will be seeking and finding work outside the city, in the immediate periphery and in oblast centers. Owing to this, the specific way of life of the closed city will acquire all the typical characteristics of Russian urban life: Life will become more dynamic, harsh and commercialized, and crime will increase. In addition to suffering the cruel influences of the new economic situation, the unique urban population that was artificially created 30-40 years ago will be subjected to serious psychological influences. Local self-management will also find itself in an unaccustomed situation under these conditions; it will be increasingly called upon to keep the accustomed way of life from falling apart.

What sort of effect might these processes have upon the future of closed cities?

On one hand it is obvious that "unfreezing" of social relations is a positive phenomenon, one which will stimulate the self-determination and self-movement of people, and as a result, stratification of the social environment. Moreover, the latter is a prerequisite of the appearance of new possibilities for self-organization of social and professional groups in the economic, social and cultural spheres, for the advent of new forms of activity, and ultimately for reduction of the dependence upon a single large production operation.

On the other hand, activation of private business activity will bring on faster departure of personnel from the main production operations. Where will these people go, in what sort of activities will they engage, and would it be possible to control this process in such a way as to prevent a sharp decline in the technological level of scientific and production activity attained in the cities?

The probability that the crime situation, which had been under complete control in these cities up to the most recent times, will worsen is another negative consequence of this sort.

What could be the directions of the efforts we will have to apply to prevent uncontrollable disintegration of these unique formations?

The most important prerequisite for the development of systems of activity that have exhausted their initial goals and resources is to advance new goals and orientations and, as a rule, to change the resources and methods of organizing the activity.

The major project implemented in the 1940's-1950's to establish closed cities predetermined world practice of this sort for not less than a decade and a half. It was not until the 1960's that centers in which scientific, technical and production potential was purposefully concentrated to support breakthroughs in areas of the latest technology began to be established in the world.

Today, the basic idea laid at the foundation of the establishment of the dispersed network of closed cities has exhausted itself in many ways. The objectives of restructuring the economic mechanism, structural reorganization of production and implementation of deep conversion require development of new principles of life for these cities, ones capable of mobilizing their development in the long range.

Special organizational and legal conditions capable of halting their degradation and compensating for the hardest losses must be provided for the unavoidable transitional period. Certain movement in this direction has revealed itself in connection with publication of the Russian Federation law "On the Closed Administrative-Territorial Formation" (July 1992), which established a special legal status for the management bodies of closed cities and special conditions for formation of local budgets, for the social protection of workers of atomic production operations and the population, for access to city territory and so on. But this is only a first step.

It was already noted above that productive and social structures of closed cities do not possess any clearly expressed internal potential for development in any directions other than those which were determined by the plan of their establishment. Implementation of conversion programs is extremely difficult in these cities precisely due to the unique social organization, the inertia observed in the thinking of their representatives, and the predominant orientation toward preserving previously evolved types of activity. Consequently artificial measures must be implemented to form active groups professionally and socially oriented on reforming productive and social structures. Considering the large numbers and high professional level of scientific and technical personnel, it is precisely in this environment that a program of social and professional activation could be initiated. Its consequences might include:

- creation of plans for reorganizing the main enterprises with the goal of transforming them into diversified production complexes having the characteristics of business firms;
- development of private entrepreneurship in the technological environment, and an active search for alternative uses of scientific and productive potential;
- development of programs of gradual integration of closed cities in the socioeconomic environment of the regions in which they are located—integration which would not only prevent a decline in the attained technological and sociocultural level, but which would also promote successive integration of nearby territories with it;

- development of the concept of a new social policy "from within the city" as a means of shaping an active population.

It seems as if development of the situation in this direction would be fully possible if the problems of preserving and developing these unique complexes are properly addressed at the federal, sector and regional levels, and if serious scientific and organizational support is provided.

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EXHIBITIONS, FAIRS

New Civilian Products of Defense Industry Enterprises at the "Conversion-92" Exhibition (Continued)

94UM0016D Moscow KONVERSIYA in Russian No 5, 1993 pp 16-26

[Article by Yuri Sergeyevich Shkarenkov; see KONVERSIYA, No 2, 3, 4, 1993]

[Text] The purpose of electrical engineering articles, materials and new production processes advertised at the "Conversion-92" exhibition is indicated, and brief descriptions and the basic technical specifications of these articles are presented.

Electrical Engineering Articles

The Intelligence-Power Electronics (ISE) Consortium advertised a wide range of electrical engineering products prepared for manufacture in 1993.

A and B high-voltage MOS-transistors are intended for use in power hybrid intelligence modules. They are characterized by high thermal stability, high input resistance in closed state, and low switching time and losses of control power and resistance in open state at high current density.

Technical Specifications

	Modification	
	A	B
Drain-source breakdown voltage (at 0 gate-source voltage), V	200	500
Maximum drain current, A	22	9.6
Resistance in open state, ohms	0.12	0.6
Maximum permissible constant dissipated power ($T_{\text{housing}}=25^{\circ}\text{C}$), W	125	125
Junction working temperature, $^{\circ}\text{C}$	(-55)-(+150)	(-55)-(+150)

Bipolar transistors with an insulated gate are intended for use in frequency-controlled electric drives intended for different purposes, in welding units with an intermediate power conversion link, power sources, induction and microwave ovens, and household appliances.

Technical Specifications

Collector-emitter voltage, V	400-1,000
Collector constant current, A	15
Gate threshold voltage, V	4.5-7
Collector-emitter backcurrent ($T_j=125^{\circ}\text{C}$), mA	2
Time, μsec :	
turn-on	0.5
turn-off	1.5

Tabled cut-off thyristors are intended for use as switching components in converters intended for various purposes.

Technical Specifications

Maximum permissible repeating pulsed voltage, V:	
in closed state	1,600-2,400
reverse	1,600-2,400

Maximum permissible repeating pulsed cut-off current, A	1,000-1,250
Turn-off time with respect to controlling electrode, μsec	16.0

Hybrid power modules based on Darlington transistors are intended for use as switching components in converters intended for various purposes. They are semiconductor electric circuit switches integrated by thick- and thin-film procedures with control, diagnosis and safety systems on a common electrically insulating backing in a single housing. They are designed as one- and two-gate circuits with reverse current diodes and shunting diodes.

Technical Specifications

Collector maximum permissible constant current, A	50-300
Collector-emitter boundary voltage, V	50-1,000
Maximum permissible constant dissipated power, W	310-1,240
Maximum permissible p-n-junction temperature, $^{\circ}\text{C}$	150
Collector-emitter saturation voltage, V, not more than	2.0
Maximum permissible base current, A	6-12

Power hybrid intelligence modules for automatic control of the operating modes of common electrical home appliances make it possible to design economical alternating current electric drives based on inverters with pulse-duration modulation (switching frequency—up to 20 kHz). These are semiconductor electric circuit switches built into a common housing with control, diagnosis and safety systems.

The module contains a bridge diode rectifier and a three-phase or single-phase inverter based on field MOS-transistors (600 V, 7 or 13 A) with reverse diodes and drivers controlling each transistor, with opto-electronic decoupling and an internal power source. It comes in an LP8 housing (European standard).

Technical Specifications

Voltage, V	
input	220, 50 Hz
output	220/127 (three-phase)
Output current, A, not more than	13 (in three-phase inverter)
	40 (in single-phase inverter)
Input (optodiode) control current, mA	20.0
Power transistor switch-on delay, nsec	500.0
Power transistor switch-off delay, μsec	1.0

SGE-0.5 and SGE-1.5 guaranteed electric power supply systems are intended for uninterrupted power supply to medical equipment, to data bank safety systems, to programmable controllers, to control and adjusting apparatus, to automation and communication resources.

to personal computers to automated work stations and so on. They guarantee interrupted power supply to consumers from a built-in sealed storage battery for 10 minutes in the event of an impermissible decrease in quality or disappearance of network voltage.

They have a built-in microprocessor diagnostic system including an accident prehistory recording unit and a programmable channel communicating with a personal computer for a "soft" restart (RS-232) program.

Technical Specifications

	SGE-0.5	SGE-1.5
Nominal active output power, W	500	1,500
Nominal output voltage (50±1 Hz), V	13	
Nominal output current, A	2.5	7.5
Overall dimensions, mm	290x357x45	
Weight (without batteries), kg	18	22

Polyfunctional power source based on MOS-transistors and power intelligence modules may be used for direct current welding, for charging storage batteries, and for starting up motor vehicle engines. It is designed for forced-air cooling.

Technical Specifications

Nominal input voltage (single-phase 50 Hz)	22+10%+10%
current, A	
Input current, A, not more than	25
Range of smooth adjustment of welding current, A	5-140
Range of smooth adjustment of welding voltage, V	15-30
Motor vehicle engine starting mode	
output voltage, V	13
output current, A, not more than	140
Storage battery charging mode	
output voltage, V	6-30
output current, A, not more than	20
Overall dimensions, mm, not more than	350x220x190
Weight, kg, not more than	19

24SG-10 sealed lead storage batteries are intended for work in compact guaranteed electric power supply systems. They are ecologically, electrically and fire-safe.

Technical Specifications

Voltage, V	
nominal	48
minimum	42
Capacity with 2-hour discharging, Ah	10

Life in charge-discharge mode when discharging with a 17.5 A current for 10 minutes, cycles not less than	200
Life, years, not less than	3
Overall dimensions, mm	310x235x150
Weight, kg	<25

Household submersible pumps based on hybrid modules and electric motors with magnetic reduction are intended to lift water out of wells and holes with an inside diameter not less than 100 mm, and out of open-air water basins, tanks and other containers and sources. Their structure is unitized. They consist of a pumping unit and a drive based on an electric motor and a semiconductor controlled-rectifier commutator made from power hybrid intelligence modules. The housings are made from a material not requiring anticorrosion paint or varnish finishes.

Technical Specifications

Delivery, m ³ /hr	1.5
Nominal head, m	63
Nominal engine power, kW	0.55
rpm (admissible)	1,350
Mean time between failures, hr, not less than	2,000
Established (2nd) and average annual running time of 200 hr/years, not less than	7
Overall dimensions, mm, p.1 more than	640x365

High-power high-voltage N-channel MOS transistor is intended for use in pulsed power supply sources, switching and pulsed units, voltage converters and electric drive units.

It comes in a KT-28-2 (TO-220) plastic housing.

Technical Specifications

	Modification		
	A	B	C
Maximum permissible voltage, V			
drain-source	60	50	45
gate-source	+20	+20	+20
Maximum permissible drain current, A	4.0	3.0	2.5
Constant dissipated power, W	60	60	50
Time, nsec			
turn-on	50	50	50
de-sat	100	100	100

The Saratov Electromechanical Production Association advertised a thermostatic cabinet, the Sokol general-purpose printed board conductor controlling unit, and color monitors at the exhibition.

Thermostatic cabinet is intended for testing components and blocks of electronic apparatus and carrying out various biological processes at higher temperature and it is equipped with automatic electronic temperature adjustment using transistorized pickups and a liquid crystal temperature display.

The height of shelves in the chamber is adjustable, making it possible to use the working volume sensibly.

Technical Specifications

Consumed power, W	
in load case	
at 12V	≤ 100
at 24V	≥ 100
in using temperature range	≤ 75
Range of working temperatures, °C	-50/125
Dimensions of work space, mm	450x470x580
Overall dimensions, mm	480x690x1200
Weight, kg	45

Sokol general-purpose unit is intended for electrical control of the integrity, topology and resistance of insulation in conductors in single-layer and multilayer printed boards.

It works together with the LK-PM-2M outfit on the basis of a coded program for each printed board.

The drive of the unit's clamping mechanism is pneumatic.

Technical Specifications

Compressed air pressure at inlet, kPa	0.6/0.8
Fuses guaranteed to conduct, A	1
Number of contacts, pairs	20/80
Electrical dimensions, mm	340x220x180
Contact field dimensions, mm	180x160

Spring-loaded point contact for temporary electrical connection of testing equipment and the contact area of a printed board provides for dependable connection of testing resources with metal-plated holes and flat contact areas on printed boards, for connection of all types of printed boards and printed cells without additional adjustments and for automatic testing of printed boards using computers.

Technical Specifications

Formal resistance, ohms not more than	10
Formal inaccuracy class, % not less than	5
Contact travel, mm, not less than	5
Number of operating cycles	10 ⁶

M32Ts and M51Ts high-resolution raster color monitors are intended to display graphical and symbolic information. They operate as part of automated systems or computers. They can be used in the presence of higher vibration and shock loads in various production spaces. The monitors have R, G, B inputs for analog video signals modulating the brightness of the principal colors, and an S-synchronization input. Monitors with a digital input for work with IBM-compatible personal computers may be supplied.

Technical Specifications

Power voltage, V	170/240
Frequency, Hz	47/60
Diagonal size, cm	17/21
Number of simultaneous displayed columns	1024

Continuous-service power systems manufactured by the Konevets enterprise are used to supply power to critical category I and II-special alternating current consumers of electric power of prescribed quality in power engineering, communications, transportation, machine building etc.

Structural diagrams of the basic versions of the system are shown in Figure 13.

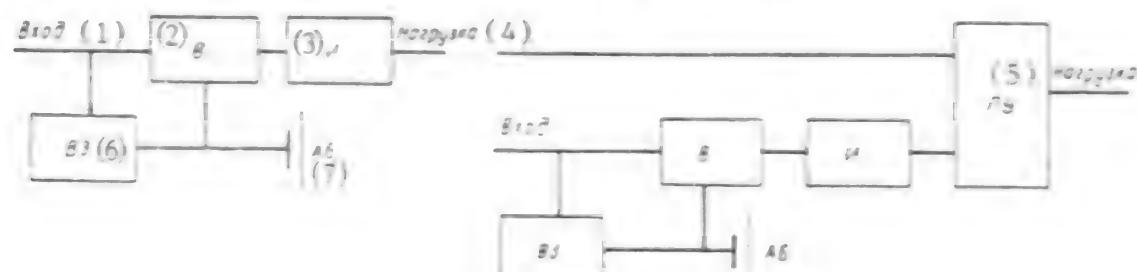


Figure 13. Structural Diagrams of Basic Versions of the Continuous-Service Power System

Key: 1—Input; 2—Rectifier; 3—Inverter; 4—Load; 5—Switching unit; 6—Battery charger; 7—Storage battery

The configuration of the circuit and the distributing units and electric machine units supplied may be changed at the user's request.

Technical Specifications

Power, kV(A)	16	31.5
Input:		
voltage, V	380 + 38/-57	
frequency, Hz	50 + 1.5/-3.0	
number of phases	3 with neutral wire	
Storage battery:		
voltage, V	240 + 30/-40	
capacity with 10-hour operation, Ah	80 or 200	
Load:		
voltage, V	380/220 +/- 2%	
frequency, Hz	50 +/- 0.5	
current, A	25	50
switching time, msec:		
thyristor gates	2-20	
electromechanical gates	less than 1,000	
Time of continuous operation at 100% load from storage battery, min	10-60	
Overall dimensions when arranged as a single row, mm	2200x600x(2200-5000)	

M-250 wind-driven electric plant, produced by the Scientific-Production Association imeni S. A. Lavochkin, is intended for production of electric power in remote areas where centralized power supply is lacking. It is used to light and power home appliances in commercial farms, the equipment of geological parties, charging units, telecommunications amplifiers, weather station equipment etc. It is outfitted with a special control unit permitting its joint operation with solar batteries, ensuring more uniform acquisition of electric power over the course of the year. It may be supplied together with a solar battery, an inverter for conversion of direct current into alternating current (220 V, 50 Hz), and a storage battery supplying power to home appliances in the absence of wind for 30 hours at a system current strength of 10 A, and for 60 hours at 5 A.

Technical Specifications

Rated power (at a wind speed of 8 m/sec), W	250
Rotor diameter, m	1.7
Wind speed, m/sec:	
minimum required for operation	2.5
maximum before breakdown	50
Storage battery capacity, Ah	350
Annual productivity (at an average wind speed of 8 m/sec), kWh	600
Life, years	15

Explosion-proof line transformer coil for second generation color television sets, produced by the TsAGI-PRIBOR State Enterprise, is intended for the repair of TBS-90LUS line transformers in combined tube-type and semiconductor color television receivers with an OS-90LTs2 deflecting system, a 6P45S output tube and a UN 8.5/25-1.2 high-voltage rectifier. The original design and winding procedure provide for high operating reliability, simplicity of manufacture and low cost. Normal operation of the transformer is guaranteed for 3 years.

IZU 250-400DNAT/220V-001U3 pulsed ignition device, proposed by the Impuls MNPP [not further identified] is used for guaranteed ignition of DNAT/220V-001U3 lamps. It is used for street lighting, in hothouses, to illuminate shops and so on. Its reliability is greater than that of its analogues, and its weight is lower; it can be repaired.

The connection circuit for the device is shown in Figure 14

Technical Specifications

Voltage, V:	
supply	220
operate, not more than	198
Ambient temperature, °C	(-45) + 70
Weight, kg, not more than	0.1

Progressive Production Processes

The Scientific Research Institute of Aviation Technology and Production Organization (NIAT) recommended the latest production processes and offered to plan and manufacture production equipment, to forward the necessary documents to the client, to sell "know-how," to organize joint production, to cooperate with foreign firms on the basis of licenses, and to engage in other forms of interaction.

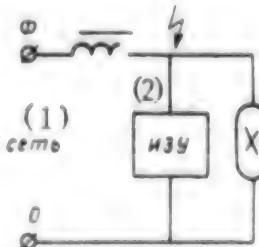


Figure 14. Pulsed Ignition Device Connection Circuit

Key: 1—Power circuit; 2—Pulsed ignition device

A procedure for obtaining cast titanium articles may enjoy wide use in the production of motor vehicles, motorcycles, bicycles, medical equipment, small sports and recreational vessels, household, industrial and agricultural pumps and fittings.

The process can be used to obtain castings up to 1,000x1,000x1,000 mm or more in size with a minimum wall thickness of 2-4 mm, and a diameter of less than 150 mm with a minimum wall thickness of 1.2 mm.

The production process includes: Optimum selection of the brands of alloys, including for implants; a means of applying a protective coating of special composition onto the working surface of casting molds making their preheating to 900-1,000°C possible; use of casting systems and filling conditions calculated with a personal computer using a special program; maximum use of titanium casting wastes in the charge without worsening the composition and properties of the alloys; integrated thermal and thermomechanical working of castings; highly effective physicochemical article finishing processes; control of composition, properties and geometry.

A process for manufacturing parts out of low-plasticity, high-strength titanium alloys is used in the production of long-life aircraft pipelines, the structural elements of aviation engines, the body parts of solid-fuel engines and so on.

It may be used in the manufacture of hollow parts and structural components at machine building plants, and equipment for petroleum, petroleum-and-gas, food, light, medical and other sectors of industry. The means, the production process and the equipment for manufacturing the parts by plastic deformation of blanks using highly concentrated heat sources at a material strength of $\sigma_B \geq 130$ kg/mm² and relative removal $\delta \leq 7.0$ percent have been developed.

The production process provides for: A savings of expensive metals and alloys owing to dramatic reduction of the extent of mechanical working of parts; a 10-20-time decrease in labor expenditures; ecological cleanliness of production; good health conditions for workers; high precision of manufactured parts, surface finish not below grad 5.

Technical Specifications

Highest productivity, mm hr	12,000
Degree of material deformation %	50-90
Article dimensions, mm	
tubing, shells, bottles	
wall thickness	0.2-10.0
diameter	50-300
length	up to 1,500
springs, bars	
wire diameter	2.0-10.0

A process for casting thin-walled castings out of high-strength structural corrosion-resistant steel with a wall thickness down to 1 mm satisfying higher requirements on casting surface finish (to Pz-20) is used to manufacture precision castings without an allowance for machining. The precision of dimensions is (+0.015/-0.6) mm depending on overall dimensions.

The particular features of the production process include: Melting in a vacuum in a controlled atmosphere; casting at residual pressure in a controlled atmosphere in shell molds without a pressure filler, situated in a controlled temperature field; extraction of models from molds by melting and a high-speed hot air flow or with high-pressure saturated steam; removal of ceramic material from the casting without abrasive working of the surface.

A production process for obtaining precision castings of pump parts out of corrosion- and erosion-resistant steel may be used in chemical industry (pumps for the production of mineral fertilizers) and oil refining industry. The particular features of the production process: Melting of 12Kh18N9TL, 07KhN25MDTL and 90Kh28MFTAL steel in induction furnaces with a basic lining; use of charge materials of higher purity with respect to admixtures, nonmetallic inclusions and gases; comprehensive deoxidation of the melt in the melting process; control of the structure of the metal by means of production parameters; manufacture of molds out of highly refractory molding materials.

The production process provides for: A 1.5-2-time increase in the steel's mechanical properties; acquisition of high quality castings of the following dimensions: a) when casting with investment patterns, 100x100x100-400x400x400 mm; b) when casting in sand molds, 200x200x200-1,000x1,000x1,000 mm; class 8-10 dimensional precision of castings (GOST 26645-85), machining allowances of 05-5.0 mm depending on casting method, overall dimensions and casting difficulty; wear resistance of 90Kh28MFTAL steel castings working as part of equipment used to produce phosphate-based mineral fertilizers that is 2.5-3 times higher than that of castings made from austenitic steel.

A process for die casting of heat-strengthened high-load parts out of aluminum and magnesium alloys is used to manufacture parts for internal combustion engines, gas turbines, compressors, pumps etc. High casting density is ensured by using special gating systems and mold filling and premolding conditions. Castings are subjected to heat treatment under T5 and T6 conditions. After heat treatment of high-strength VAL-14 alloy, the cut-out pieces have the following characteristics: $\sigma_B \geq 400$ MPa, $\delta \geq 10\%$.

The characteristics of parts at higher operating temperatures are improved with subsequent static gas treatment. Use of this procedure makes it possible to significantly reduce the machining volume, the weight of parts

and energy expenditures, and to improve the commercial appearance of the article.

Isothermic stamping of precision blanks of complex shape is used in manufacturing a wide assortment of parts out of aluminum, magnesium and titanium alloys, including watch housings, parts of medical and sports equipment, and so on. It is a resource-conserving, low-waste production process making it possible to approximate the shape and dimensions of the stamped blank to those of the finished article. Blanks are distinguished by small surface mating radii (0.5-3 mm), absence of drafts on exterior surfaces in the case of closed-die forging, and small drafts (0.5-3°) on interior surfaces and elements.

The process provides for: Higher precision of stamped blanks, with 80-90 percent of surfaces not requiring machining; reduction of metal expenditure by a factor of 2-3; decrease of labor-intensiveness of milling by 20-60 percent; higher quality and better operating characteristics of articles; improvement of working conditions and the ecological situation in forging and stamping production.

A superplastic molding process combined with diffusion welding is intended for the manufacture of complex three-dimensional structures out of sheet titanium alloys, including high-strength alloys. It provides for high unit strength of structures and good surface quality. Molding is carried out with general-purpose thermal equipment using specialized gear.

The process makes it possible to manufacture molding component structures within a single cycle, to reduce article weight, to increase the metal use coefficient and to reduce the labor-intensiveness of part manufacture.

The NIAT offers automated systems for industrial preparation of casting production (ASTPP LP):

1. An automated system for evaluating the technological feasibility of cast parts (ASOT LD) obtained by casting in temporary and permanent molds, making it possible to select the material of the blank and a sensible part manufacturing process with regard for technical and economic factors (the casting method, the labor-intensiveness and cost of manufacture etc.).

2. A system for automated planning of casting production processes (SAPR TP) using sand molds, metal molds and investment patterns. The system allows the user to determine: The sensible shape of the blank, the optimum position of the casting in the mold, the parameters of the gating system, the means of preventing casting defects, melting and casting parameters, the content of the production processes, the equipment, and the technical and economic indicators of a production process.

The system creates a set of process documents that is printed out in the particular enterprise's standard format. The system foresees functions permitting archival storage of production processes and printout of

planning records enumerating the system's recommendations and the decisions made by the process engineer.

3. A system for automated planning of shaped casting feed systems (SAPR SPO) making it possible: To input and change the configuration of the casting and mold (in a format compatible with the AutoCAD system); to calculate the magnitude and locations of heat units and shrinkage defects (shrinkage porosity); to evaluate the influence of casting conditions on them, and to select sensible engineering concepts regarding the planning of casting feed systems.

4. An expert system for analysis of casting defects when casting in metal and sand molds (ESADL), which provides a possibility for determining the type of defect on the basis of the results of visual control and laboratory analysis, to reveal the causes of defect formation, and to plan a package of production measures necessary to correct a defect.

An induction brazing process used on stainless steel and titanium alloy pipelines with a diameter of 6-42 mm in stationary, including cramped, conditions and simultaneous brazing of multtube (2-5 tubes) connections is employed in the production of TU-100, SU-27, Il-76, Il-86, Il-96 and Burana airplanes.

Brazing is carried out by means of special remote inductors and connecting cables.

A process for shaping abruptly bent branch pipes out of aluminum and titanium alloys and stainless and carbon steel is based on ramming a billet with a low melting point or elastic filler into the detachable die of a special press tool operating with internal pressure.

Manufacture of branch pipes out of seamless round billets increases the life of the pipeline by 2-3 times and reduces the labor-intensiveness of manufacture by 1.5-2 times in comparison with branch pipes made by die forging and welding.

An automated production process for manufacturing large parts out of polymer composite materials makes it possible to obtain parts such as bodies of revolution of complex shape and closed profile 4,000-12,000 mm long and 50-2,500 mm in diameter. Parts possess maximum strength at minimum weight, which is achieved by orienting the filler in the direction of load action. Series-manufactured NK coil winders are used as the production equipment.

* * *

Several effective production processes were advertised by the Scientific Research Institute of Engine Production technology and Organization (NIID). Staffed with experienced specialists, the institute is ready to provide the necessary assistance on a contract basis in introducing new production processes, in manufacturing, installing and starting up production equipment, in providing maintenance to the equipment, and in training specialists.

Abrasive electrochemical low-waste cutting of high-strength materials into uniform blanks is based on electric diamond machining of materials in electrolyte regardless of their mechanical properties. A new general-purpose pulsed power source was developed to supply electric power to the unit.

Productivity is 2-3 times greater and the quantity of wastes decreases by 4-5 times in comparison with abrasive cutting and cutting with Heller saws.

The resulting blanks do not have any burrs, burns or cracks on machined surfaces.

Technical Specifications

Blank diameter, mm	up to 180
Cutting width, mm, not more than	0.5-0.8
Tool feed rate during cutting, mm/min	50
Roughness of machined surfaces (R_a , μ)	0.32
Precision	meets quality level no. 9

A rotational deformation process makes it possible to use model V-29 and V-245 machine tools to obtain cylindrical and conical parts with a curvilinear indicatrix, including with a stepped shape, with or without a bottom, and with a flange. The round sheet blank may be obtained, for example, by stamping.

Technical Specifications

	Machine tool model	
	V-29	V-245
Part dimensions, mm:		
diameter	10-120	10-220
wall thickness	2-3	2-3
maximum length	120	320
Number of rollers, each	2	2
Greatest longitudinal force, kN	70	100
Precision of:		
inside surface	meets quality level no. 7	
outside surface	meets quality level no. 9	
Roughness (R_a , μ)	0.8	

Microarc oxidation of high-strength aluminum alloy parts subjected to erosional and abrasive wear, and of friction parts and units (parts for engines and machine units, equipment for production of consumer goods, bushings, pistons, cylinders etc.) improves the operating characteristics of the articles, reduces the labor-intensiveness of their manufacture and their cost, and decreases the structure's weight owing to the possibility for substituting steel and cast iron parts by lighter ones. Their wear (when coupled with chromium steel) is practically nonexistent when lubricant is present; the layer is elastic (chipping is not observed with shock deformation), and it is a dielectric with high resistivity.

Technical Specifications

Thickness of strengthened layer, μ	10-200
Microhardness, GPa	10-20
Hardness, HRC	60
Heat resistance, °C	1,000

A process for shot-blast cleaning of parts made from titanium and aluminum alloys and steel and working under the conditions of sign-variable loading which foresees the use of metal balls is used to clean scale and corrosion from parts, to remove microburrs and round off sharp edges, and to create a microrelief on surfaces that are to be subsequently painted and coated. The balls are manufactured by centrifugal spraying of melted metal.

Technical Specifications of Microballs

Diameter, mm	0.05-0.315
Density, kg/m ³	8,520
Hardness, HRC	46-48

A process for shot-blast cleaning of parts made from titanium, aluminum and magnesium alloys and steel working in the presence of sign-variable loading which utilizes glass balls makes it possible to obtain a stable, uniform microrelief ($R_a=0.63-0.16 \mu$), to raise the fatigue limit of parts by 15-30 percent and life by 2.5-4 times, and so on. It is used to remove burrs, to round off sharp edges, and to create an optimum microrelief on surfaces prior to their coating.

Technical Specifications of Balls

Diameter, mm	0.4-1.2
Density, kg/m ³	2,300
Hardness, HRC	42-46
Wear resistance, %	80
Average operating time, cycles	1,000

A process for shot-blast cleaning of low-stiffness parts, parts of complex shape and parts with structural stress concentrators ($R=0.55\text{mm}$) made from titanium, aluminum and magnesium alloys and steel working in the presence of sign-variable loading makes it possible to obtain a stable, uniform microrelief ($R_a=0.3-0.16 \mu$), to raise the fatigue limit of parts by 15-35 percent and life by 2.5-5 times, etc. The microballs are manufactured by melting quartz sand or sheet glass in a plasma.

Technical Specifications of Microballs

Diameter, mm	0.05-0.2
Density, kg/m ³	2,300
Hardness, HRC	46-48
Wear resistance, %	88

Materials

The Red Army Scientific Research Institute of Mechanization (KNIIM) has organized production of a number of **high-melting inorganic materials** on the basis of developments of the Institute of Structural Macrokinetics. These materials are obtained by a method of self-propagating high-temperature synthesis entailing the burning of a specially prepared charge in an inert or reactive gas atmosphere. Inorganic substances of different classes used in many sectors of industry are formed as a result of combustion.

Titanium carbide is used to make abrasive powders, pastes and abrasive tools; to apply wear-resistant coatings; to manufacture electrodes for electrolysis and oxygenless cutting of steel. The material does not interact with melted metals (bismuth, aluminum, cadmium, cobalt etc.), with mineral acids and alkali solutions, and it resists reducing gases.

Chromium carbide is used as an ingredient in charges for powder electrode cores, as a surfacing material, as an ingredient of tool alloys, for filters in chemical industry, in catalysts, for application of coatings and manufacture of parts for acid-transferring pumps. Chromium carbide is resistant to acids, and it is not decomposed by alkali solutions. It oxidizes at a temperature above 100°C.

Titanium diboride is intended for manufacture of abrasive powders, pastes and vaporizing elements, and for application of high-temperature corrosion-resistant coatings. It is used in high-temperature steel, in hard cermet alloys to cut metals and drill rock, in sandblaster nozzles, and for TiB₂-Ti cermets in nuclear engineering. It is resistant to hydrochloric, sulfuric and phosphoric acids, and it dissolves most actively in nitric acid. When heated, its resistance to all acids decreases dramatically.

Corundum alloyed with chromium (pink corundum) is used for plasma spraying and in abrasive materials and articles. Wheel made from pink corundum can work hard alloys, which makes it possible to replace elbor in these operations.

Tungsten disulfide is used as a catalyst in oil cracking, to hydrogenate brown coal in the acquisition of synthetic liquid fuel, as a solid lubricant for various units in which it is impossible to use liquid lubricant (in a vacuum and at high temperatures), as a lubricating component in composite materials (porous bronze for example), in the manufacture of self-lubricating plain bearings, and as a motor oil additive. It is stable in air to a temperature of 400°C, in a vacuum to 1,000°C and in an inert medium to 1,400°C. It decomposes in concentrated nitric and sulfuric acids, in aqua regia, in melted alkalis and in oxidizer solution.

Tungsten disulfide alloyed with niobium is used as an ingredient in the manufacture of electric brushes and other electric contacts. Alloying tungsten disulfide with niobium reduces electrical resistance to that of graphite, and provides for acquisition of a conducting solid lubricant.

Molybdenum disulfide is used in sliding contacts, including in electric brushes, and as an ingredient of lubricants and coolants. It is stable at room temperature in air, it oxidizes when heated in air at 400°C, and when heated it is stable to 1,300°C in an inert medium and 1,000°C in a vacuum. It decomposes in concentrated nitric and sulfuric acids and in aqua regia. Its antifriction properties are not inferior to those of natural molybdenum disulfide.

Molybdenum disulfide alloyed with niobium is used as an antifriction material, particularly as a component of electric brushes and commutating contacts, and in small nonwire resistors.

Boron carbide is intended for use as an ingredient of high-temperature and heat-resistant alloys, structural ceramics and composite materials (as effective protection against neutron radiation and to regulate the yield of fast reactors), for biological protection, and as a model of an ultrahard abrasive material. It is resistant to acids and to alkali solutions.

Titanium nitride is used to apply coatings, as an ingredient of high-strength alloys, composite materials and refractory materials, for crucibles used to melt high-melting materials, as a conducting material in thorium cathodes, and as an abrasive.

Hexagonal boron nitride is intended for acquisition of cubic and wurtzite-like boron nitride, in the manufacture of high-temperature insulators and refractory linings, and for biological protection of reactors. It is used as an ingredient in dielectrics, as a high-temperature lubricant, as heat insulation in high-frequency induction furnaces, to produce linings for muffle furnaces, and in ceramic materials used in the manufacture of wear and erosion resistant parts for magnetohydrodynamic generators. It is heat-stable to 3,000°C, and it possesses high electric insulating strength, low dielectric characteristics and a high capacity for absorbing radioactive radiation. It is resistant to mineral acids, and it dissolves in hot alkalis.

Aluminum nitride is used as a heat-conducting dielectric filler in composite materials, as an ingredient in vacuum-tight ceramics in electronic and radio industry, to line electrolysis baths, to manufacture protective stems on thermocouples etc.

Technical Specifications

Parameters	Titanium Carbide	Chromium Carbide	Boron Carbide	Titanium Nitride	Hexagonal Boron Nitride	Aluminum Nitride
Density, kg/m ³	4.930	6.740	2,400-2,500	3.210	2,290	3.270
Melting point, K	3,210	2,168	2,623	3,220	3,273	2,573-2,773
Resistivity, μOhms	0.52-0.22	0.75	-	0.25	More than 10^{17}	More than 10^{14}
Microhardness, GPa	31	13	-	117	-	12
Chemical composition of powder, % by weight	Total carbon, not less than					
	18.0-19.5	11.0-13.0	21.5	-	-	-
	Free carbon, not more than					
	0.2-0.5	0.5-0.6	0.3	-	-	-
	Titanium	Aluminum	Total boron	Titanium	Main ingredient	Nitrogen
	77.0-79.5	2.5-2.7	77.3	77.0-78.5	95.0	29.8-31.5
		Chromium—remainder		Nitrogen	Nitrogen	
				20.3-21.5	53.6	

Parameters	Tungsten Disulfide	Tungsten Disulfide Alloyed With Niobium	Molybdenum Disulfide	Molybdenum Disulfide Alloyed With Niobium	Titanium Diboride	Corundum Alloyed With Chromium (Pink Corundum)
Density, kg/m ³	7.630	6.300	4,800	-	4,520	-
Melting point, K	-	-	1,458	-	3,253	-
Resistivity, μOhms	0.14	0.4	8.51 Ohms	400^{-5} Ohms	-	-
Microhardness, GPa	-	-	-	-	33	20.5
Chemical composition of powder, % by weight	Tungsten	Total sulfur	Molybdenum	Total sulfur	Total boron	Aluminum
	72.5-74.5	24.5	59.0-61.0	39.5-41.5	29.0-29.5	47-50
	Total sulfur		Total sulfur	Niobium	Titanium	Chromium
	24.0-26.4		38.0-41.0	2.9	68.7-69.0	5-10

Ultradispersed diamond powder advertised by the Elektrokhimpribor Combine is a fundamentally new material obtained with energy produced by an explosion. It is used as a powerful cross-linking agent in various materials (rubber, ceramics, plastics) to significantly improve characteristics, as a fine grinding material for special-purpose glass and mirrors (in laser engineering for example), in heat-transmitting materials in electronics, in antifriction additives for oil for motors, machinery and machine tools, in solid lubricants, and in galvanic coatings based on diamonds and various materials (chromium, nickel, silver, copper, cobalt etc.).

Manufacture of polycrystalline diamonds out of ultradispersed diamond powder for different sectors of the national economy (cutters, crown bits, bearings, structural parts) is promising. Average particle size is 40-50 angstroms.

The Solikamsk Ural Plant advertised colloxylin and dry pastes.

Linoleum colloxylin (colloxylin "L") is used to manufacture linoleum, celluloid and other materials.

It is a cellulose nitrate obtained by processing cellulose with a mixture of solutions of nitric and sulfuric acid and water.

Technical Specifications

Nitric oxide concentration by volume, ml/gm	175-194
Chemical stability, ml NO/gm, not more than	2.5

Varnish coloxylin (PSV coloxylin) is used to make varnishes used in the finishing of furniture and other wood articles.

It is a nitrate obtained by processing cotton cellulose with a mixture of solutions of nitric and sulfuric acids.

Technical Specifications

Nitric oxide concentration by volume, ml/gm	190-196
Chemical stability, ml NO/gm, not more than	2.5

Dry rolled SVP pastes for ordinary and autonitrocellulose enamels of different colors are intended for the manufacture of NTs-25 nitrocellulose enamels used to paint wooden and primed metallic surfaces of articles and equipment for indoor use, and NTs-11 autonitrocellulose enamels used to paint automotive equipment. They are produced in the form of plates and tablets of arbitrary shape.

Technical Specifications

Proportion of volatile substances by weight, %, not more than	4.0
Average weight, gm, of:	
plates	2.0-3.0
tablets	1.2-2.0

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	Phone: (834-22) 9-67-49
Scientific-Production Association imeni S. A. Lavochkin	141400, Khimki-2, Moscow Oblast, ul. Leningradskaya, 24

	Phone: (095) 573-90-56
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	Telex: 911721 IRBIS RF
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(To be continued)

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**CONFERENCES, SYMPOSIA,
SEMINARS**

The Russian Army and Defense Industry in a Market Economy (Conclusion)

94UM0016F Moscow KONVERSIYA in Russian No 5, 1993 pp 27-34

[Article: see KONVERSIYA, No 4, 1993]

[Text] *The content of the principal documents presented at an international conference devoted to the problems of high technology and conversion, small business and conversion, spiritual conversion in the Army, the geopolitical aspects of conversion, ecology and conversion, and other subjects (2-4 December 1992, Moscow) is briefly presented.*

Nikitin, Yu. I. and Sokolov, T. P. (Center for Psychosocial Adaptation of Former Servicemen and Their Families) dwelled in their report "Psychological Adaptation of Servicemen Under Market Conditions" on the fact that a significant number of servicemen, engineers and technicians of the military-industrial complex are currently suffering a unique form of stress as a result of growing social defenselessness. Growth of nervous and mental disease, social apathy, alcoholism and drug addiction,

and an increase in crime are a natural consequence of this. Analysis of statistics shows that the total number of suicides in CIS countries now exceeds 30,000 per year. The age distribution of suicide victims has changed dramatically (while their average age used to be 18-25, it is now 35-40 years).

Medical and psychological research conducted on civilians by the center revealed that in distinction from many of their civilian peers, who have quickly developed a pragmatic attitude and sometimes a shameless desire for enrichment at any price, a "wild," out-of-control market is evoking sharp protest among servicemen. This creates one of the boundaries of the society's stratification and, consequently, psychological stress.

One of the ways of relieving psychological stress in former servicemen is to provide effective assistance in retraining in occupations the country needs most of all in the time of transition to a market economy (managers, businessmen etc.). This retraining should be conducted with regard for individual personality features. The Center for Psychosocial Adaptation of Servicemen under the Garmoniya International Corporation, which is staffed by medical workers, psychologists, managers, educators and representatives of the spiritual sphere, has developed the principles of training and psychosocial adaptation of demobilized servicemen and their families.

The goal of the project: In connection with conversion of defense industries and profound restructuring of the Armed Forces, there is now an urgent need to provide servicemen and their families with additional knowledge in economics, marketing, financing and special subjects with the purpose of their active inclusion in civilian production and entrepreneurship. Determining the possibilities of each specialist through special testing is an important objective of the project.

The principles of the project:

1. **Regional scope.** The project is implemented with regard for regional priorities. Unification and standardization of training centers established by the project must be rejected.
2. **Openness.** The project presupposes broad participation of different public and production organizations and structures, including foreign, in its development.
3. **Independence.** Presence of alternative types and kinds of schools and retraining centers, tailored both to specific centers and spheres of business, is required. State and private centers must enjoy equal legal status, and they must be independent of their political bodies.

The main directions of the project are: Psychological testing of servicemen and specialists, and analysis of personality characteristics; analysis and forecasting of

individual capabilities; use of psychological and psychotherapeutic methods for the personal adaptation of servicemen and their families; retraining of former servicemen and specialists of defense enterprises in particular sectors, with special emphasis on training for petroleum and gas industry, the agroindustrial complex and the Mosmetrostroy [not further identified]; and retraining of personnel exhibiting the needed capabilities in fundamentally new specialties: Managers, production organizers in the small business area, services, etc.

Under the conditions of decentralization and demonopolization, former soldiers seeking knowledge in management and commerce would be able to shelter the market economy in the best way possible from the negative influence of a clan and mafia-based economy, since they know quite well from their own experience the social and moral value of defending "the honor of the uniform." They have the power to establish organizations making the most sensible use of freed military property in social programs for the disabled and war veterans, and for the needs of the families of servicemen.

In order to attract resources for social adaptation of demobilized servicemen from sources other than the budget, the center is lobbying for tax privileges for private persons and companies sponsoring its activity.

The personal experience of the center's associates shows that this work must be combined with establishment and the practical activity of decentralized cost-accounting and private groups, organizations and firms providing medical and social assistance and services to former servicemen and their families.

In particular, a training center for the training of managers and businessmen, in which former servicemen and their families are eagerly participating, was organized. Experience shows that it is best to conduct this work in suburban boarding hotels, where training in the principles of entrepreneurship may be combined with psychological adjustment. V. A. Molodetskikh, a member of the center and a Docent of the Department of Psychiatry and Medical Psychology of the Moscow Medical Institute imeni Semashko, has developed an original program directed at preventing and eliminating stressful states.

Another member of the center, Vice President of the All-Russian Association of Nontraditional Methods I. O. Vagin, has developed a program making wide use of the experience of Slavic folk medicine and Eastern medicine. The association is prepared to render this form of services to servicemen and their families at reduced rates.

Two programs were conducted by Christian physicians from the USA at the Medicine and Humanitarianism Center in July 1992 within the framework of joint cooperation with religious organizations in order to provide consultative and therapeutic assistance to many disabled servicemen. The center is prepared to widen the

volume of psychological and social assistance to servicemen, their families and workers of the military-industrial complex. Anyone wishing to is invited to cooperate.

Kuznetsov, M. N. ("For the Spirituality of the Army and Navy" Union) gave a report titled "Spiritual Conversion of the Army," which examined problems associated with practical exercise, in the Armed Forces and other military departments of the Russian Federation, of the constitutional right of citizens to the freedom of consciousness and of the law "On Freedom of Religion." The author said that Article 50 of the Russian Federation Constitution and the law "On Freedom of Religion," which guarantee the right of a citizen to freedom of religious worship, are not working in the Army and in other military departments.

General N. S. Stolyarov asserted in a radio speech that 25 percent of servicemen in today's Armed Forces are true believers, and 35 percent are undecided. Even these figures are far from the truth because the bulk of young draftees conceal their real attitude toward religion, because in the Army it sometimes happens that crosses are torn from the necks of young Orthodox soldiers, prayer books are confiscated, on Saturdays Adventists are assigned to housekeeping duties, and Muslims are forced to eat pork.

In the Ufa Military Helicopter School for example (school chief, Major General of Aviation Lysenko), older servicemen force Orthodox privates Aleksandr Kurbatov and Dmitriy Ivanov to perform push-ups to exhaustion, and if they fail to perform the established norm, they are beaten. Lieutenant Shaykhutdinov ordered them to remove their crosses, promising to create hell for them in event of their failure to carry out his instructions. There are many such examples.

Law violations arising on the basis of violation of the constitutional rights of citizens to freedom of conscience are only part of the big problem of human rights violations in the Army.

At the same time the educational structures of the Ministry of Defense and other military departments assert in chorus that we have no problems regarding satisfaction of religious needs in the Army. They say that the Army does not need a clergy, inasmuch as this would be the mechanical substitution of one ideology by another, but they do not object to establishment of contacts by military units with local parishes, and they promise to fill the libraries with religious literature.

What is being done today in different spheres of our society to ensure the religious rights of believing servicemen, and spiritual conversion in the Army and the Navy?

1. The Russian Federation Supreme Soviet and the Committee on Freedom of Conscience, Religion and Charity proposed more loyal wordings in the draft of the law "On the Status of the Serviceman" and began writing

supplements and amendments to provisions in the law "On Freedom of Religion" that are not entirely satisfactory in relation to the Army.

2. In the last year and a half, the Army community created around 10, and perhaps even more, public religious organizations in the center and in the periphery with the main purpose of reviving spirituality in the Army and religious education of soldiers. The following were organized just in Moscow: The "Military Servicemen for Spiritual Rebirth of the Army" Public Religious Interconfessional Movement; the "Church and Army" Orthodox Committee; the "Truth and Courage" Association; the Association of Military-Political and Military-Historical Researchers; and the Russian Reserve Officers' Club for Spiritual Rebirth of the Union.

The "For Spirituality of the Army and Navy" Union (founder—Russian National Aviation Association), which the author represents, states its main goal to be rebirth of spirituality and spiritual culture in the Army through the introduction of a clergy. The movement's organizing committee currently includes representatives from the largest religious associations of the Russian Federation. Participants of the movement are striving to bring closer the day when clergy could freely meet with their flocks in military units. But the efforts of these organizations are piecemeal, there is no coordinating body, and the miserly assets apportioned to solving the problems of spirituality are not concentrated on reaching the main objective. Mutual understanding is often lacking among persons of like mind. An urgent need has arisen for establishing a body that would consolidate the efforts of all forces interested in reviving spirituality in the Army.

What in our opinion could correct the state of affairs of religion in the Army? First of all, practical implementation of the constitutional right to freedom of conscience in the Armed Forces and in other military departments of the Russian Federation. Second, inclusion of representatives of the clergy and the army religious community in the Ministry of Defense working group to develop the concept of indoctrination of Russian Federation Armed Forces personnel, so that the term "spiritual conversion" would acquire the right to exist in the state's military policy. Third, introduction of a clergy into the Army as a mechanism by which to revive spirituality and spiritual culture of soldiers; in this case the formula for revival of spirituality in the Army must be developed by the religious associations themselves, in their own interconfessional forum. For the moment, however, considering the lack of clergy, it would be suitable to open up the military units to pastors. From our point of view, the military priest must work together with the military psychologist; only then will the number of suicides among servicemen decrease. While there are 28 cases of suicide for every 100,000 servicemen today, in 1914, when belief in God was widespread, there were only 3 cases per 100,000.

Popov, Yu. P. (Moscow Institute of Chemical Machine Building) provided information on the commercial faculty of the "Conversion" postgraduate organization, which proposes to train specialists (engineers and officers) with the purpose of providing engineering support to conversion and to development of new science-intensive production processes, machinery and apparatus in chemical and associated sectors of industry (the agroindustrial complex, food and light industry).

Training may be in attendance, by correspondence, in evening classes, and through extension courses.

The training time is up to 6 months, and the students are accepted year-round without examinations, regardless of age.

The main directions of training are:

- Profound conversion of defense enterprises and armament.
- Development of science-intensive and high technologies, and parallel production operations.
- Solution of the problems of ecology, waste recycling, and energy and resource conservation.
- Cryotechnology, plasma chemistry, microwave technology, bioengineering, polymer machine building.
- Reliability and corrosion protection.
- Production of substances and materials with special properties, and especially pure substances and compounds.
- Automation, mechanization and computerization.
- Quality control and certification systems.
- Automatic planning systems (SAPR).
- Programs of scientific and engineering support to developments in production.
- Adaptation to the market and contacts with foreign partners, etc.

Gromova, M. N. (International Center for Development of Small Enterprises) dwelled on the problems of financial support to conversion and small business. Discussing the needs for investment, the author noted that conversion is an expensive process. For example implementation of a package of projects under the state specific-purpose programs "Conversion of Civil Aviation," "Revival of the Russian Fleet," "Conversion of the Timber Complex," "Conversion of Processing Sectors of the Agroindustrial Complex," "Commercial Farmer" and "Conversion in Ecology" required around 100 billion rubles in additional investments just in 1992. Solving the problems of financing conversion remains the most pressing task of the next 2-3 years, inasmuch as enterprises undergoing conversion will be able to survive only if they are supported against monopolies.

Financial support to enterprises undergoing conversion and support to implementation of specific-purpose conversion programs may be provided from a large number of sources:

- a fund set up specifically to assist conversion;
- state budget assets for implementation of specific projects at the level of state conversion programs;

- municipal budgets.
- the resources of enterprises.
- the resources of innovational funds.
- through preferred loans granted to specific projects
- deductions from the sale of arms and military equipment produced by enterprises for export.
- receipts from public funds.
- foreign investments.

Finances and loans are provided today to specific conversion projects. The technological similarity between the products to which the enterprise is switching and the products it manufactured prior to conversion, and the market demand for the new products are evaluated in this case.

Special attention should be turned to supporting small enterprises established on the basis of defense enterprises. Conversion created favorable conditions for their appearance within the defense complex. Being a more flexible form of production organization that is easier to control, the small business could take on many tasks both in production of civilian products and in fulfilling a number of main and auxiliary operations in military production, thus promoting development of competition and entrepreneurship. However, most of the 700 currently operating small businesses established on the basis of the military-industrial complex are small businesses engaging in intermediary operations, construction and information, and only a small number are involved in production. There are practically no small businesses in the salvaging of military and technical resources, raw materials and supplies, in connection with which the salvaging of retired military-technical resources as well as those subject to destruction in accordance with international agreements have to be carried out by the manufacturing plants, to which this form of activity is in a sense a sideline.

The experience of small businesses in the defense complex suggests that there are considerable production, scientific, technical, organizational and financial difficulties in this sphere of management. There is the low equipment level of small businesses; the low level of mechanization of auxiliary operations, freight handling and transportation; an insufficient orientation on local resources or production wastes, and local markets; and imperfections in management systems copying the management structure of large and midsized enterprises. The absence of financial and other forms of support at the state and regional levels is slowing down the development of small enterprises, and the small enterprises themselves still lack sufficient resources to introduce high technology production operations. Because of numerous instances of reorganization in response to change in its departmental subordination, the Committee on Support of Small Enterprises and Entrepreneurship, established at the state level in 1992, and called upon to shape policy in matters relating to small

business and to provide financial support to small businesses, has been deprived of the possibility for using its support fund for its intended purpose.

The difficulties may be compounded with further growth of the number of small enterprises that are being established unless a system of comprehensive support to small entrepreneurship is developed and implemented. It is fully obvious that effective development of a network of small enterprises would be impossible without a clearly conceived system of such support on the part of state bodies, regions, individual enterprises and organizations. Now that establishment of regional conversion centers such as the Ural and Northwestern centers is proceeding actively, the problems of supporting small enterprises within the framework of regional programs could be solved.

It would be suitable to form separate structures, including financial and loan organizations, specially oriented on work with small enterprises.

Surikov, B. T. (Russian Academy of Sciences Institute of the USA and Canada) said in a report titled "Conversion and Ecology" that the latest armaments can and must be used within the framework of conversion, rather than being mindlessly destroyed. For example, ecological monitoring could be carried out with rockets, airplanes and even satellites.

Nuclear power engineering has accumulated large amounts of wastes, burial of which would be economically disadvantageous and ecologically dangerous. Consequently it would be suitable to dispose of them outside the Solar System, in distant space.

The Baltic Sea problem is one of the most immediate conversion projects associated with ecology. German chemical bombs left over after the Second World War are beginning to disintegrate in the sea. They could be raised and rendered harmless after freezing with liquid nitrogen.

Money apportioned to conversion and to ensuring ecological security should be spent on real things, and not on chimeras. We can include among such chimeras the so-called inter-SDI, or the "space global shield," which would of course be capable of preventing aggression such as Saddam Husayn's war against Kuwait, but such wars could also be averted by more modest means. And when it comes to impacts by new Tungus meteorites or space bodies of lesser weight, such a "shield" will be no help. It has been calculated that a heavy "stellar rainstorm" will occur in the first decade of the 21st century. We should be preparing for it now for the sake of future generations.

Sergeyev, V. P. ("Alfateks" Scientific-Technical Center) dwelled on the use of idle military production operations for business and ecology. In two years of work, the scientific-technical center has accumulated experience in interacting with state organizations and foreign partners in machine building, power engineering, medicine, ecology, quantum technology, textile production, etc.

Nonetheless, production processes intended for systems of complex interaction of three types of radiation—nuclear, magnetic and acoustic wave, which are capable of changing the structure of metal, remain unused. For example the wear resistance of an irradiated bearing increases by 10 times, while that of an automobile tire increases by 25 percent. Appropriately treated fuel raises the quality of combustion while reducing wastes. It is also possible to sterilize flour, powdered eggs and so on by irradiation.

The scientific-technical center possesses four oil well fire extinguishing units that produce astounding results (the fires in the oil fields of Kuwait during the 1990 war could have been extinguished in just a few hours). These units are made out of metal withstanding a temperature of 1,200°C.

Complex irradiation is used to treat dirty wastes from leather, metallurgical and other production operations. Nuclear-magnetic diagnosis is possible using just 20 milligrams of blood.

Tuboltsev, M. N. ("Columb" Expedition) described conversion and ecological safety programs to be presented during the around-the-world journey of the "Columb" Expedition. The expedition is being organized with several ships of the Black Sea Fleet ("Sobinov," "Akademik Korolev," "Yuriy Gagarin" and others) for a four-month voyage around the world. The goal of the expedition is to encourage commercial organizations to develop or support conversion and ecological projects; to reach the objectives of the Biosphere program supported by UNESCO; to establish a floating university of the biosphere, conversion and ecological safety in collaboration with the Garmoniya Center. Travel of the ships from the ports of Kerch, Sudak and Feodosiya along separate routes (for example to Great Britain in December 1992 and to India in January 1993) should compensate for the outlays on the expedition ahead of time, and attract foreign partners to cooperate with Russians.

Mukhachev, A. I. ("Sotsmedeko" [not further identified]) noted in a report titled "On the Mechanism of Managing Ecological Survival" that the management structure of ecological programs requires complete replacement. First we need to achieve ecological survival, and then ecological security. We should begin with the individual, the family. For this, it would be suitable to establish: 1) commercial investment banks supporting ecological projects, because resources for them cannot be found in state and central banks; 2) an interbank union; 3) holding companies; 4) an institute of social ecology with the corresponding support and a separate conversion department; 5) a consortium consisting of members of the Association to support conversion projects and ecological security; 6) an international coordinating council on ecological security under the association indicated above; 7) ecological security forces made up of disbanded chemical and civil defense forces.

Litvin, L. M. ("Conversion and Agrosphere" Joint-Stock Company) noted in a report titled "Conversion and Agrobusiness" that military high technology is being used extremely widely by the joint-stock company, in particular, incineration of wastes or their plasma processing. The company built several showrooms in which the possibilities of military aviation in agrobusiness and ecological monitoring are displayed. The subsidiary enterprise Aviakonversiya offers uninterrupted supply of spare parts for any dual-purpose aviation systems including MiGs, for example.

Besides engaging in military technical issues, the company distributes land in Tula, Ryazan and elsewhere to servicemen discharged into the reserves. Problems arise in this case in relations with local administrations wanting compensation for worked land. A state institution will probably be able to resolve these problems. This will also help the rural residents to positively solve the tight money problem themselves. According to some forecasts, the money they received for the 1992 harvest should run out by as early as February 1993 due to inflation. Thus, the government's concern for the life of former servicemen will also help to stabilize life in the countryside. Moreover, former servicemen have the background for successful participation in science-intensive agricultural production.

In distinction from the West, which is offering us assistance in training commercial managers, we are staking our bets on former servicemen, whom we train as technical personnel and production organizers.

Mchedlishvili, B. V. (Russian Academy of Sciences Institute of Crystallography) said in a report titled "Science-Intensive Production Processes From Medium Machine Building Institutes" that production processes used formerly for defense could be used for nonmilitary production. For example, ions in a nuclear accelerator can create products for small and midsized business—for example, films or membranes used in blood purification (hemosorption, plasmapheresis). Such "nuclear filters" could be used successfully to treat AIDS, to obtain ecologically clean food products and cosmetics, and for the storage of donor plasma during blood separation.

Smirnov, V. A. and Savinova, N. M. (Obninsk) dwelled on the use of a nuclear accelerator to obtain commercial products and on the use of space equipment in small and mid-sized business. Acquisition of metallic, plastic and other membranes using a nuclear accelerator requires extremely modest investments of R5-15 million. Obninsk has land, foil and so on as security for such an investment. A pump without a single moving part that was used in space in weightlessness was demonstrated to visitors. It is intended for transfer of electrolyzing liquids and for prudent spraying of chemicals in agriculture.

Eric Wood (Joint Venture Development Corporation, USA) said in a report titled "Ethical Problems in Conversion and Business" that conversion does not presuppose introducing a form of production which would

permit defense-related technology to be squandered in a free market. In the USA, the government participates in conversion programs everywhere and nowhere. In Russia, where conversion programs are only just beginning to appear, Western business should invest resources into people, and not into machines, because business ethics are clearly lacking. For many here, even a contract, which is sacred to a Westerner, has no role to play. When one is violated, they say "This is Russia."

Russia has acquired a negative reputation in the West. Businessmen are now angry not at the system but at individuals. The impression is created that rather than a corrupt system influencing the actions of people, corrupt people are controlling the system.

Two standards and two prices have evolved for Russian and foreign entrepreneurs. Why must an American pay two or three prices for the same thing? In a free market after all, the winner is he who offers two or three things for the same price.

Taxes collected from American businessmen are growing, but crime in Russian cities in which they are operating is also growing. All of this creates a negative image of Russian business.

Money is not my goal. An "I won, you lost" philosophy leads to ruin, while if both you and I win, this promises cooperation for many long years.

My experience shows that a contract is not necessary when dealing with an honest person. It is now said that there are no laws regulating business. It may be that we need not enact laws that create obstacles to honest business. I have noted that the "technical difficulties" observed in relations between Russians and Americans do not arise between Russians. Especially when it comes to buying Mercedes' and applying for loans from the West.

Eric Wood noted in a speech devoted to the financing of conversion products and the problem of trust that conversion requires large amounts of money and a lot of time. The West is in no hurry to give out large sums due to the lack of trust in the new Russia. A climate of trust has to be created. In this case, it all should begin with interpersonal relations, such as those for example between the author and representatives of the Garmoniya business intelligence center.

There is a universally recognized system of trust in the world (agreements, the obligation to fulfill previously accepted obligations, the so-called "grandfather law"). A system of personal trust apart from macroeconomics is currently being established. There are no dishonest systems today—there are only dishonest people. In order to grant loans, one must have faith in a person 10 years into the future, especially in such areas as conversion and ecological security.

Skorodumov, S. V. ("ROKONT" acronym for Russian conversion and new technology) Joint-Stock Company)

examined. In a report titled "Systems of Compact Intelligent Production for Accelerated Transition of Defense Enterprises to a Market Economy," the concept of reequipping enterprises of the military-industrial complex and selecting the priority directions of their development in conjunction with creating systems of compact intelligent production out of technology of a new generation, and widely introducing them.

The author noted that conversion of the defense complex, which requires renewal of products, production processes, and equipment, raises to the forefront the problem of selecting the priority directions of reequipping production, which is closely associated with social, economic and ecological problems, and with economization of resources and energy. All of these problems must be solved integrally.

The "ROKONT" Joint-Stock Company has developed a detailed plan for implementing specific technical and economic decisions. This plan defines the procedure of creating compact intelligent production (KIP) systems on the basis of an analysis of foreign and Russian experience in developing the high technology of production and designing new production equipment, control resources and software. The company has also established a scientific research and experimental design system, and determined the necessary level of technical support (equipment, instruments, computers, materials etc.) and of the human, production and financial resources necessary to attain the set goal.

In their general form, KIP systems are self-contained controllable production operations integrated into a network of cooperative ties with producers of raw materials, supplies and associated articles, units and machine units.

The following principles are at the basis of the organization structure of KIP: Constant tracking of the market for the selected objects of production, specialization on particular objects of production and extensive cooperation; integration of planning, design, preparation and control of the article manufacturing process, continual updating of the information base, continuous accumulation of professional knowledge in the system on designing a chosen class of objects of production and on the procedures of their manufacture.

KIP systems reduce the time it takes to design and manufacture ordered articles, and they increase the quality of production, labor productivity and equipment loading. They make it possible to organize with minimum outlays of live labor, minimum expenditure of raw materials and energy, in minimum work space, a production process that includes start-to-finish planning, design and preparation of production, manufacture of science-intensive articles and of molding equipment for precision casting, stamping, vacuum molding and other processes of series production. KIP modules may be duplicated at machine building plants for the purpose of creating modules specialized for particular production sectors.

Areas of Use of KIP Systems

Machine building (main and auxiliary products)	Planning, pattern-making and manufacture of molding equipment for the production of articles, parts and complete units of casting equipment prototype articles, master die models, aerodynamic models, lasts, athletic equipment and other consumer goods
Medicine medical instrument making	Manufacture of prostheses for limbs, bones and joints, models of internal organs, equipment for the production of medical tools and instruments, etc.
Science architecture art education	Planning and manufacture of objects of complex shape, models of architectural structures, design models, sculpture molds, furniture parts, theatrical properties, copies of monumental art

KIP technology differs from traditional methods of production in that reactions to change in structure and parameters of articles are fast, with the emphasis shifted from mass production to production on the basis of individual orders.

Enterprises of the military-industrial complex forced to switch to civilian production should be the first to be interested in creating and using a KIP. Creation of KIP systems at these enterprises may become part of Russia's national industrial policy.

At the same time, according to data of the International Small Business Conference (Moscow, October 1992), thousands of small scientific, technical and production enterprises that must have highly effective production equipment if they are to win a place in the market and maintain their competitiveness have an acute need for KIP systems.

In the next few years we need to create a subsector of new technology, of new production resources and of engineering services aimed at rendering practical assistance in setting up production of science-intensive goods at midsized and small enterprises with a scientific, technical and production profile.

Small production enterprises furnished with KIP systems could play a special role in introducing the accomplishments of scientific and technical progress into consumer goods production, raising the employment level of the population, reviving folk arts and crafts, solving ecological problems, and effectively developing technical creativity among the young. Such small enterprises could be established in practically all sectors of the national economy. A form of private small business that leases a KIP system from a midsized or large industrial enterprise that will assume the responsibility of providing all engineering services associated with organizing effective operation of production equipment may be found to be the most suitable under the new economic conditions.

Creation of KIP systems will make it possible:

- to ensure wide introduction of a new generation of production systems into Russia that correspond to the best world models, together with full automation of the production of new-technology products and consumer goods;
- to work out the principles of creating production operations based on high technology and new production equipment software and principles of organization of automated production under the conditions provided by small enterprises;
- to organize duplication of entire KIP systems or their individual modules on the basis of orders from industrial sectors in Russia and other countries;
- to create a complex of production equipment that is characterized by a high concentration of operations, provides for an automatic work cycle and brings together planning, design, production preparation, control, diagnosis and adjustment, automatic adjustment for manufacture of new parts, and integration with automated production control systems, automated design systems and systems of a higher level.

KIP systems consist of equipment maximizing on effectiveness indicators—usefulness/cost or functions/expenditures, which equalizes to a certain degree the production possibilities of large and small producers.

The place KIP systems could occupy in the immediate future in the modern economy in the manufacture of different types of products may be compared with that which has been occupied today by microprocessors in data processing systems.

What makes the KIP concept new is:

- creation of resource-conserving high precision and ecologically clean processes for manufacturing articles of complex three-dimensional shape for different areas of use;
- development of production equipment based on the use of new physical principles and employment of promising physicotechnical effects;
- creation of special computer hardware and software and intelligent systems for the performance of start-to-finish planning, design, preparation of articles for production and their manufacture;
- creation of the latest component base for KIP systems intended for different sectors of the national economy, including machine building, instrument making, aviation and automotive industry, construction and production of furniture, medical tools and consumer goods;
- development of new principles of organizing production of articles under a KIP system.

The key problem of organizing and creating Russian KIP is that of developing production support and production equipment that would make it possible to use the results of leading-edge applied technological research and development to radically solve the problem of molding

models and prototypes when producing articles and equipment for other production methods used in series and mass production.

Operation of experimental KIP models showed that they have the following advantages over traditional production systems:

- the possibility for start-to-finish planning, design and manufacture of articles in a single integrally automated work place;
- reduction of the production expenses of placing new products into production by 2.5-3 times;
- shortening of the time of the cycle of preparing new articles for production by 3-5 times;
- reduction of the cost of article production by 2-3 times;
- reduction of production and warehousing space by 5-10 times;
- fast manufacture of articles of complex shape on the basis of special orders (in 1-2 weeks rather than 3-4 months);
- fuller utilization of materials (a material use coefficient of up to 11.9);
- minimum payback time of equipment (6-12 months).

The prospects and feasibility of using KIP systems as a new approach to the production of parts, assembly units and finished articles of complex shape was demonstrated by a number of American and Japanese firms working in different sectors of the economy.

The "ROKONT" Joint-Stock Company, the founders of which total 23 organizations, brings together most of the engineers, scientists and producers participating directly in the development of new technology and KIP equipment.

Research by the "ROKONT" Joint-Stock Company, directed at creating KIP systems is proceeding in three principal directions:

1. Development and manufacture of the production equipment TPS-1 modules for manufacture of articles out of sheet polymers and composite materials; TPS-2 modules for the manufacture of articles out of liquid photosensitive polymers, and TPS-3 modules for the manufacture of articles out of powdered materials.
2. Development of the software of the integrated intelligent system for planning and controlling the production processes of layer-by-layer synthesis.
3. Creation of geometric information input systems. Geometric modeling systems, systems for analyzing and inputting graphical information from drawings, and systems for inputting and processing three-dimensional images of real objects.

The work being done by the "ROKONT" Joint-Stock Company does not exhaust the entire spectrum of problems associated with creating KIP equipment. "ROKONT" is cooperating with the leading enterprises of the military-industrial complex in developing new

materials and creating highly reliable industrial lasers and special optics, and it hopes to utilize the freed potential of defense enterprises to introduce and carry out series production of KIP equipment.

All of the conditions necessary for organizing production of KIP processes and equipment and introducing them on a wide scale have already matured in Russia.

The plan developed by the "ROKONT" Joint-Stock Company is directed at comprehensive solution, in the shortest time possible (1993-1995), of the problem of creating technological support and the most up-to-date component base for a Russian family of KIP systems based on new physical principles.

Implementation of this plan will make it possible for Russian industry to establish the foundation for significant structural changes and improve production of a new generation of the means of production in the next few years, and it will allow thousands of small and midsized enterprises using KIP systems to raise the quality of their products to the world level.

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PRESENTATIONS

Central Scientific Research Institute of Economics, Information Science and Control Systems (TsNII EISU)

94UM0016G Moscow KONVERSIYA in Russian No 5, 1993 pp 35-37

[Text] The TsNII EISU is a state-run firm within the main administration of armament industry under the Russian Federation Committee on the Defense Industry. The firm is currently being transformed into an open joint-stock company.

Established in 1969, the TsNII EISU has extensive experience in conducting scientific research in economic analysis and planning of information and technical production control systems, and of systems for comprehensive information protection and computer security in the defense industry.

In more than two decades of work, the Institute has formed a wide circle of permanent clients, including defense and civilian enterprises, military organizations, state bodies of administration, design and research firms, and commercial structures.

The TsNII EISU possesses a modern material and equipment base, an information and computer center, and testing facilities.

Scientific research and contract work is done by qualified personnel, the total number of which reaches 1,000. Of them, 600 are scientific associates and specialists. The TsNII EISU employs 94 specialists possessing academic degrees and academic titles.

The executives of the firm and its subdivisions have considerable experience in scientific research, scientific production and education. They are leading specialists in automation of information processing, program planning, the economics of the defense complex and production control. They have taken part in the development of proposals and recommendations on economic reform of the defense complex, and of drafts of legislative acts at the request of state bodies of administration.

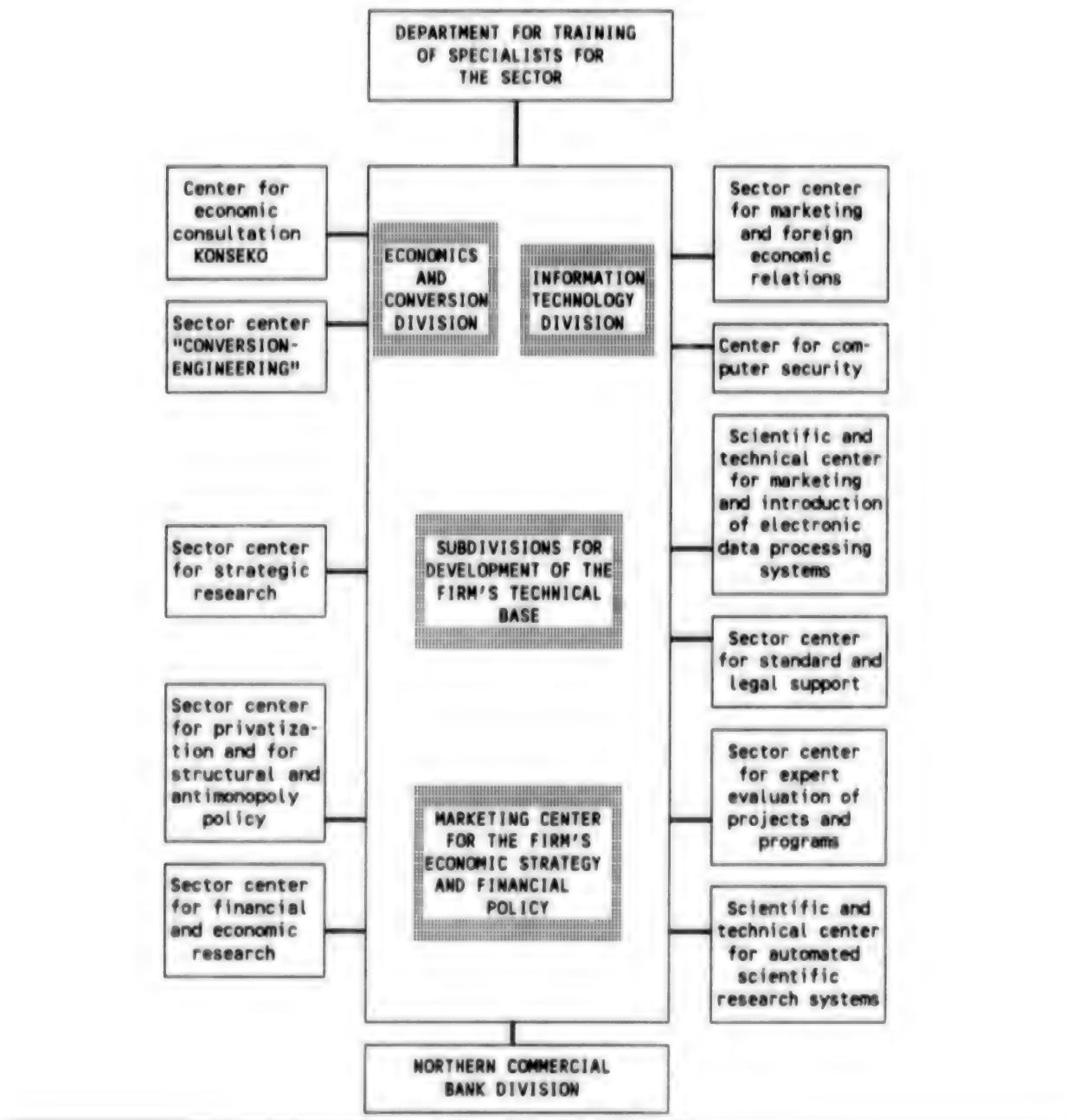
The principal directions of scientific research are:

- planning armament and military equipment programs, and developing and locating production capacities;
- developing priority programs for creating and developing production procedures and justifying their resource support;
- evaluating the scientific and technical potential of different sectors (military and civilian machine building, metallurgy, instrument making, optoelectronics etc.) and practicability of programs;
- determining the strategy for development of defense industry during transition to a market economy, and the sector-specific features of privatization and of antimonopoly and structural policy;
- working up the concepts of conversion of military production with regard for the adopted doctrine of sufficient defense;
- expert evaluation of conversion projects and assessment of their socioeconomic consequences;
- monitoring conversion programs under way at the regional level and at the enterprise level;
- developing programs for transfer of scientific and technical accomplishments from the defense complex to civilian sectors;
- technical and economic monitoring and analysis;
- creating information processing software and hardware, and plans for automated control systems;
- teaching specialists to work in a market environment, and training specialists specifically for the sector.

The TsNII EISU has completed the following most important projects and developments:

1. The concept of privatization of enterprises of the defense complex (1992).
2. Scientific and methodological support to privatization of enterprises (1992).
3. Development and introduction of the "Integrated System of Accounting and Analysis of the Availability of Commodity and Material Valuables at Enterprises" (1991-1992).
4. Development and introduction of the "Functional-Cost Analysis" system (1991).
5. The concept of transition of defense sectors to market relations.
6. The concept of conversion of defense industry and assessment of its socioeconomic consequences (1991).

Structure of the TsNII EISU Firm



7. Development and introduction of the following sector systems (1988-1991):

- “Scientific and Technical Forecasting of New Technology”;
- “Specific-Purpose Program Planning of New Technology”;
- “Ergonomic Support to New Technology.”

8. The concept of the creation and function of the federal register of military industrial information (1992).

9. The concept of economic monitoring (1992).

The TsNII EISU is one of the three leaders of the consortium of head economic institutes of defense and other leading sectors of machine building. (The two other leaders are the Scientific Research Institute of the Economics and Planning of Aviation Industry and the

Scientific Research Institute of the Economics and Complex Communication Problems of Communication Resources Industry. The consortium contains another nine members in addition to them.) It is using the currently operating information infrastructures of these sectors to establish the Federal Register of Military Industrial Information, which is a system of polyfunctional information distribution bases united by an integrated computer net, by standards and protocols of information exchange, and by a common administrative service into an integrated data bank of standards and of factual, graphical and analytical information. This register is based on the intellectual, software, hardware and information potential of the head economic institutes.

The Federal Register regulates information support to central federal bodies of administration, to enterprises and organizations in material production, and to banking and other structures, including commercial ones, throughout all of the Russian Federation and in CIS countries.

The register is based on a developed system of regional information and analytical centers located in all oblast, rayon and other industrial cities of the Russian Federation and CIS countries. It possesses long-distance (apportioned) channels of communication with the Central Information and Analytical Center in Moscow, which is being established in the form of a system of parity centers made up of economic institutes existing as members of the consortium and united by a single regional computer net.

Users of the Federal Register of Military Industrial Information are provided the following information services:

- the possibility for using long-distance communication channels and resources for information exchange with any subscribers to the Federal Register's system;
- regulated access to the information bases of the Central and any other regional information and analytical centers;
- access to international computer nets and computer nets functioning within the Russian Federation and in CIS countries.

The software and hardware of the Federal Register guarantees integrity of data, sanctioned access by users, and maintenance of state and commercial secrecy in the performance of all information services. It supports the most up-to-date procedures of information interaction with data bases in the course of interactive information exchange by users.

Data bases containing standards and factual, graphical and analytical information are kept current in the Federal Register.

Professor Mikhail Ilich Nikitin is the director of the Institute

Professor Vladimir Vladimirovich Pimenov is the first deputy for scientific research in the area of program planning, conversion and technical-economic research.

Vasiliy Stepanovich Serdyukov is the deputy director for scientific research in information science.

The address of the TsNII EISU:

103104, Moscow, Tverskoy bulvar, d.7/2
International telephone communication: 7-
095888-20059
Telephone communication within the country: (095)
290-60-17
Fax: (095) 290-44-45
Telephone communication in the Iskra-2 system: 20-059

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LISTING OF CONVERSION PRODUCTS, FACILITIES

Conversion Information Bank

94UM0016E Moscow KONVERSIYA in Russian No 5,
1993 pp I-II

[Text] Elems-6U 70 manganese-air-zinc battery with alkaline electrolyte supplying weak-current intermediate communication apparatus at railroad points (manufactured by order). Capacity—70 Ar, current—60 mA, nominal voltage—4.2, 5.6, 2.8 V, warranty period—12 months, overall dimensions—182x128x114 mm, weight—3.7 kg.

Uralelement Plant

456800, Verkhniy Ufaley, Chelyabinsk Oblast, ul.
Dmitriyeva, 24
Phone: (351-64) 9-23-36; 9-23-16
Fax: (351-64) 2-42-22
Teletype: 624265 DUBLER

Automated lines and equipment for processing and producing oil and fat products and oxidizing drying oils.

Iskra Scientific-Production Association

614038, Perm, ul. akademika Vedeneyeva, 28
Phone: (342-2) 72-80-00; 72-80-19
Fax: (342-2) 34-94-22 (international); 72-84-68
(republic)
Teletype: 134162 NOTA

Nuclear membranes made from polyethylene terephthalate film for use: In electronic industry for fine cleaning of air and of gaseous and liquid production environments (production of integrated microcircuits and semiconductors); in research on and monitoring of environmental pollution; to extract valuable components from poor solutions and production wastes; in cryogenic technology, etc.

Joint Institute of Nuclear Research

141980, Dubna, Moscow Oblast
 Phone: (095) 926-22-34; 926-22-61; 157-09-48
 Telex: 412621 DUBNA SU

Synchronous sealed electric drive with transistorized converter and liquid cooling for pumps, compressors, fans. Power—1.2 kW, efficiency—75 percent, guaranteed running time—4,000 hr, weight—65 kg.

All-Russian Scientific Research Institute of Electromechanics

107817, Moscow, GSP-6, Khoromnyy tupik, 4
 Phone: (095) 923-16-34
 Fax: (095) 207-49-62
 Teletype: 111807, 417203 ALIT

Program input device providing for interactive communication between an operator and a microcomputer and permitting input of a large volume of information from a read-only memory to the microcomputer's main memory. Data transmission rate—up to 9,600 bits/sec, ROM capacity—up to 128 kbytes per cassette.

All-Russian Scientific Research Institute of Electromechanics

107817, Moscow, GSP-6, Khoromnyy tupik, 4
 Phone: (095) 923-16-34
 Fax: (095) 207-49-62
 Teletype: 111807, 417203 ALIT

Assembly equipment for microelectronics: General-purpose ultrasonic welding equipment, loading devices (primarily for flat objects), precision coordinate and rotary systems (force-free predominantly), and motion transducers (chiefly photoelectric).

Planar Scientific-Production Association

220763, Minsk, Partizanskiy pr., 2
 Phone: (0172) 21-77-25; 21-30-29; 26-12-05
 Fax: (0172) 21-24-07
 Telex: 252171

Manufacture of lots of color and monochromatic reflecting holograms out of existing original holograms (30 subjects); holography of objects in museums and private collections; manufacture of pins and articles bearing holographic images; manufacture of art objects out of optical glass with holograms. Delivery time (approximately 100 units)—1 month. Price—negotiable.

AO INVA (NIKKI OEP VNTs GOI [not further identified] imeni S. I. Vavilov)

188537, Sosnovyy Bor, Leningrad Oblast, a/ya 3/3
 Phone: (812-69) 4-80-04; 6-25-17
 Fax: (812-69) 4-53-73

Elems-4F manganese-air-zinc battery (manufactured on order) with alkaline electrolyte supplying rail transport conductor lanterns. Capacity—9.0 A/hr, current—300 mA, nominal voltage—4.0 V, warranty period—9 months, overall dimensions—92x63x120 mm, weight—1.2 kg.

Uralelement Plant

456800, Verkhniy Ufaley, Chelyabinsk Oblast, ul. Dmitriyeva, 24
 Phone: (351-64) 9-23-36; 9-23-16
 Fax: (351-64) 2-42-22
 Teletype: 624265 DUBLER

Element GR6 (316) lithium-cupric oxide chemical power source with organic electrolyte supplying microcalculators, electric watches, hearing aids, transistor radios, television and radio equipment, measuring instruments etc. (manufactured on order). Capacity—3.0 A/hr, nominal voltage—1.5 V, warranty period—60 months, overall dimensions—φ14.5x50.5 mm, weight—18 gm.

Uralelement Plant

456800, Verkhniy Ufaley, Chelyabinsk Oblast, ul. Dmitriyeva, 24
 Phone: (351-64) 9-23-36; 9-23-16
 Fax: (351-64) 2-42-22
 Teletype: 624265 DUBLER

Manufacture of individual gifts, souvenirs: Plaques, paperweights, ashtrays and desk sets made from optical glass and integrated with holography and the use of other optical effects. Articles may be personalized with company logos, symbols, trademarks and company names at the client's request.

AO INVA (NIKKI OEP VNTs GOI imeni S. I. Vavilov)

188537, Sosnovyy Bor, Leningrad Oblast, a/ya 3/3
 Phone: (812-69) 4-80-04; 6-25-17
 Fax: (812-69) 4-53-73

Procedure for predicting reliability of interlayer bonding of multilayer printed boards and operational control of the procedure of their manufacture on the basis of the results of thermocyclic tests on test coupons.

All-Russian Scientific Research Institute of Electromechanics

107817, Moscow, GSP-6, Khoromnyy tupik, 4
 Phone: (095) 923-16-34
 Fax: (095) 207-49-62
 Teletype: 111807, 417203 ALIT

Indirect statistical optimization method based on self-organization, used to determine the most effective technical solutions in the development and perfection of complex objects and systems in different fields of science and engineering.

AviAvto Scientific-Production Laboratory

125190, Moscow, a/ya 228
 Phone: (095) 155-15-99; 155-10-04; 250-82-73
 Fax: (095) 250-82-73

We invite cooperation in the production of glass microspheres (over 100/gm) intended for Klintron burn center beds, to process medical instruments, for fine working of the surfaces of vacuum chambers, for fine ecologically clean processing of stainless steel food pipelines, containers and vessels with spheroidal particles

with dimensions of 45-90, 90-160 and 160-250 μ . We have the production process, feasibility studies, production space in Sosnovyy Bor, and equipment and raw materials in the Leningrad region.

NIKI OEP

188537, Sosnovyy Bor, Leningrad Oblast
Phone: (812-69) 4-80-04
Fax: (812-69) 4-53-73

MSA1 device for signature control of conducting connections in various cords and distribution frame devices (boards, panels and cabinets). Consumed power—30 W, overall dimensions—150x450x270 mm, weight—7 kg.

All-Russian Scientific Research Institute of Electromechanics

107817, Moscow, GSP-6, Khoromnyy tupik, 4
Phone: (095) 923-16-34
Fax: (095) 207-49-62
Teletype: 111807, 417203 ALIT

Electromagnetic and magnetic activators and extruders for various purposes; **equipment for cable production**.

Iskra Scientific-Production Association

614038, Perm, ul. akademika Vedeneyeva, 28
Phone: (342-2) 72-80-00; 72-80-19
Fax: (342-2) 34-94-22 (international); 72-84-68
(republic)
Teletype: 134162 NOTA

Technical work-up of different types of gas turbine aviation engines (gas-dynamic design, designing of basic components, calculation of characteristics under steady-state and variable conditions, assessment of weight indicators of the main components and of the engine as a whole).

AviAvto Scientific-Production Laboratory

125190, Moscow, a/ya 228
Phone: (095) 155-15-99; 155-10-04; 250-82-73
Fax: (095) 250-82-73

Elems-9M manganese-air-zinc battery with alkaline electrolyte supplying the Elektronika-302, Tom-206, VEF-260, Vesna-207 and other tape recorders. Capacity—6.0 A/hr, current—250 mA, nominal voltage—9.0 V, warranty period—9 months, overall dimensions—32x55x155 mm, weight—420 gm.

Uralelement Plant

456800, Verkhniy Ufaley, Chelyabinsk Oblast, ul. Dmitriyeva, 24
Phone: (351-64) 9-23-36; 9-23-16
Fax: (351-64) 2-42-22
Teletype: 624265 DUBLER

Legal support for inventions and protection and use of industrial property.

NII EKOS [not further identified]

113209, Moscow, Zyuzinskaya ul., 6, korp. 2
Phone: (095) 332-35-09; 332-35-37

Fax: (095) 331-05-11; 331-09-00
Telex: 412264 BOND SU

Linear step drives, fixed contacting units, welding heads for microelectronics.

Planar Scientific-Production Association

220763, Minsk, Partizanskiy pr., 2
Phone: (0172) 21-77-25
Fax: (0172) 21-24-07
Telex: 252171

Development and supply of automated systems for testing equipment series-produced by machine building sectors of industry out of personal computers and resources specially developed for communication with an object of testing.

All-Russian Scientific Research Institute of Electromechanics

107817, Moscow, GSP-6, Khoromnyy tupik, 4
Phone: (095) 923-16-34
Fax: (095) 207-49-62
Teletype: 111807, 417203 ALIT

Baken VTs-1 manganese-air-zinc battery with alkaline electrolyte supplying light signaling devices on navigation barriers on inland waterways. Capacity—250 A/hr, current—240 mA, nominal voltage—2.6 V, warranty period—15 months, overall dimensions, 128x114x182 mm, weight—3.5 kg.

Uralelement Plant

456800, Verkhniy Ufaley, Chelyabinsk Oblast, ul. Dmitriyeva, 24
Phone: (351-64) 9-23-36; 9-23-16
Fax: (351-64) 2-42-22
Teletype: 624265 DUBLER

Program package for automated planning of production processes in structural metal brazing, with editing and printing outputs.

All-Russian Scientific Research Institute of Electromechanics

107817, Moscow, GSP-6, Khoromnyy tupik, 4
Phone: (095) 923-16-34
Fax: (095) 207-49-62
Teletype: 111807, 417203 ALIT

Image generators for direct-exposure images of special-order circuits and connections in the production of redundant integrated circuits.

Planar Scientific-Production Association

220763, Minsk, Partizanskiy pr., 2
Phone: (0172) 21-77-25
Fax: (0172) 21-24-07
Telex: 252171

TK-15 molten adhesive for fast attachment of conductors and cords, as well as of electronic articles onto printed boards in assembly work. Sets as it cools in 10-15 sec.

All-Russian Scientific Research Institute of Electro-mechanics

107817, Moscow, GSP-6, Khoromnyy tupik, 4
Phone: (095) 923-16-34
Fax: (095) 207-49-62
Teletype: 111807, 417203 ALIT

Industrial rubber articles: glands, compensators, cuffs, gaskets.

Iskra Scientific-Production Association

614038, Perm, ul. akademika Vedeneyeva, 28
Phone: (342-2) 72-80-00; 72-80-19
Fax: (342-2) 34-94-22 (international); 72-84-68
(republic)
Teletype: 134162 NOTA

Groups organized for two-week training in the USA and Holland, business contacts established, foreign partners found.

INNOTEK Center for Innovation and Development
125183, Moscow, a/ya 0023, Belousova, L. N.
Phone: (095) 442-78-80 (from 0900 to 1300)
Fax: (095) 366-98-11

Korund manganese-air-zinc battery with alkaline electrolyte supplying transistorized receivers and other apparatus. Capacity—1.0 A/hr, current—17 mA, nominal voltage—8.5 V, warranty period—9 months, overall dimensions—26.5x17.5x48 mm, weight—40 gm.

Uralelement Plant

456800, Verkhniy Ufaley, Chelyabinsk Oblast, ul. Dmitriyeva, 24
Phone: (351-64) 9-23-36; 9-23-16
Fax: (351-64) 2-42-22
Teletype: 624265 DUBLER

Development of highly reliable parts and units for machine building.

Iskra Scientific-Production Association

614038, Perm, ul. akademika Vedeneyeva, 28
Phone: (342-2) 72-80-00; 72-80-19
Fax: (342-2) 34-94-22 (international); 72-84-68
(republic)
Teletype: 134162 NOTA

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